THE GLASS INDUSTRY

VOLUME 25. NUMBER 10. OCTOBER. 1944

DISCUSSIONS ON POTS AND QUALITY CONTROL HIGHLIGHT GLASS DIVISION FALL MEETING

One hundred and ninety-two members registered for the Fall Meeting of the Glass Division, Hotel Schenley, Pittsburgh, September 13-14. This, the sixteenth and the largest of these meetings, assembled in the city where the Division was organized, 1919. Observance of this twenty-fifth anniversary will take the form of a brief history of the Division, to be prepared by its Secretary.

Local arrangements were ably handled by J. S. Gregorius, Pittsburgh Plate Glass Company. The splendidly appointed Fellow's Room in the Mellon Institute was made available for technical sessions, through the courtesy of the staff. The program was prepared by Louis Navias, Vice Chairman, who was unable to attend because of pressing duties at General Electric Company. K. C. Lyon, Armstrong Cork Company, presided as Chairman.

Many of the members joined a tour of inspection of the Mellon Institute laboratories on Wednesday morning. In the evening, a large number accepted Professor Alexander Silverman's invitation to see his amazing collection of glassware, ancient and modern, in his office in Alumni Hall, on the old Pitt campus.

The technical session on Wednesday afternoon was devoted principally to the discussion of the glass melting pots and their behavior. Among the points emphasized by the different speakers were the following: Molten glass is a universal solvent for all of the inorganic oxides. Accordingly, it is not to be expected that any wall made up of oxides can permanently resist corrosion. No great progress seems to have been made in the manufacture of pots in many years, although as one or two of the speakers optimistically suggested, it always appears that improvements can be made if pains are taken with the construction and treatment of the pots. It appears that the more siliceous clays are more desirable than the highly aluminous clays. Some of the speakers thought that especial care in the arching of pots was the most important single factor in their life. Some attention was given to the structural weaknesses of pots which could be laid to the infirmity of some of the older potmakers.

All in all, the picture as presented was not one of encouraging progress. It seems as though this particular phase of the industry could not by any means keep pace with the technical and mechanical developments in the glass industry as a whole. Apparently the glass pot is still only a make-shift or compromise between what we would like to have and what the manufacturer of clay wares would give us. However, it should be noted that the speakers in this symposium all represented glass manufacturers. It seems that if any immediate improvement in the condition of glass pots is made, it would be as a result of work that is now being carried on in the glass factories. A large part of this will deal with the heat treatment and use of the pots, as well as with their original composition. It is quite likely that much the same description of glass pots and their failings would have been made if this symposium had been held a generation ago.

At the same meeting, Professor W. A. Weyl, director of Glass Science, Incorporated, presented an interesting description of the approach made by his organization to different types of glass manufacturing problems. The plan seems to be to have available specialists in various fields of science, who may or may not be connected with the glass industry, but who are capable of directing graduate research in these specialized lines for immediate help in solving manufacturing problems. Unity is achieved by calling the entire group together several times during the year. Eventually, when the results have been thoroughly discussed and have been reduced to experience, they will be made public property.

At the close of the afternoon session, ASTM Committee C-14 held a brief session under Vice-chairman E. W. Tillotson, Mellon Institute. The only interesting items handled dealt with a proposed new sub-committee and with the report of the committee on nomenclature and definitions, whose definition of glass will now be submitted to Committee E-8 and then circulated for vote by Committee C-14.

The session on Thursday forenoon on refined methods of quality control developed into a series of demonstrations of the value of statistical methods. Such methods, it was pointed out can be applied to any type of defect

that can be reduced to numbers and measurements. Necessarily, such defects as cords depicted by a shadowgraph cannot very well be expressed in quantitative terms, hence, do not very well lend themselves to statistical methods. An interesting feature of the symposium was the introduction of a large number of examples by engineers from other industries showing how production could be improved and how the source of trouble could be located by proper attention to determination of statistical means and allowable variations.

A faintly amusing circumstance was the fact that one speaker used up a great deal of his time explaining that the statistical method took too long to explain, whereas the following speaker gave in about ten minutes a rather understandable, rough-and-tumble explanation of the statistical method. It is to be expected that as a result of these presentations more technologists will lose their fear of the mathematics of statistical analysis and presently achieve better results by its use.

The particular application to the glass industry by Dr. L. G. Ghering, Preston Laboratories, was especially interesting, not only for the complete set of control charts on density measurements which he presented, but also because of his demonstration with a dozen smooth dice that the expected "x-bar" for "six seeds in a half inch cube" is two; whereas using a dozen dice that afterward turned out to be loaded, the average occurrence runs up to something worse than six.

The paper delivered by J. Manuele, Director of Quality Control, Westinghouse Electric and Manufacturing Co., entitled "Elementary Principles of Quality Control" is reprinted in full elsewhere in this issue.

At the luncheon meeting on Thursday, Dr. Frank W. Preston delivered brief eulogies of two members of the Division who died during the past year; L. T. Sherwood of Dunbar, Pennsylvania and Lt. Samuel Meyer, Jr., of Glenshaw, Pennsylvania.

For the golf event on Thursday afternoon, Mr. Gregorius arranged to have the courtesies of the Longue Vue Golf Club extended to the Division members. On this beautifully kept and scenic course over-looking the Allegheny River, seventeen members competed for the O. Hommel Trophy presented by Ernest Hommel, president of the O. Hommel Company. A low net of 72 was achieved by two men from the Kimble Glass Company, Fred Pinotti, and Kenneth Henry. These men agreed to play off the tie on their home course, and the event was won by Mr. Pinotti.

Following are summaries of seven of the papers:

Introduction to the Use of Statistical Methods. *Ly F. W. Preston, Preston Laboratories.*

Statistical methods, by their very nature, can only be applied to observations of number or to measurements. "Quality Control" therefore is most easily applied to those industries where the "dimensions" or "size" of something is the primary consideration, and measuring these dimensions or sizes are well worked out.

In the glass industry quality control techniques might save a great deal of time and cost in inspection, but the techniques can only be applied to things that can be measured. Therefore, a serious program must be undertaken to find measurable properties around a glass factory, or in the glass itself, so that quality control techniques can be applied to them. When this is done we may expect to detect any change, for better or worse, in the factory operation, with promptnes. Such procedures may in fact reduce the vast amount of individual inspection that is now required.

The process of making a measurement is itself a recipro cal process. You can measure only with measuring apparatus or devices. If these devices are perfect and constant, we get a check on the product. If the product is known to be constant, we get a check on the measuring tools. At present there is a lack of suitable measuring tools for much of the data available in the glass industry. A successful application of quality control techniques therefore depends upon the development of measuring equipment or measuring procedures on which the techniques can operate efficiently and promptly.

Background, Explanation, and Application of Statistical Control Charts in War Industries. *By Dr. Holbrook Working, Chief, Quality Control Program, OPRD (WPB).*

The control chart has two principal uses—assisting judgment with regard to whether a state of control exists, and attaining control of quality during production. The ultimate and most important purpose of the control chart is to provide a definite operational procedure for controlling quality in the manufacturing plant. The first purpose for which the control chart is used is often that of analyzing the quality records of the past.

A control chart is set up and used as follows: a tentative standard level of control for use in future operations is adopted usually on the basis of past experience and control limits are set above and below the standard level at distances determined with a view to the number of observations to be taken each time the product is sampled. The values obtained from inspecting the samples are then plotted on the chart as soon as they are obtained. A plotted point falling outside the control limits is taken as an indication of the presence of a disturbing cause of variation in the production process. This cause of variation should be identified, and if practicable, eliminated. The control limits thus serve as a criterion for action. By repeating this procedure—the identification of causes of variation and then elimination—over and over again, and by taking steps to prevent recurrences, the quality is brought closer and closer to the state of control. As time goes on, newly acquired data provide fresh information for computing revised control limits and, if desired, for adjusting the standard level as well. In this case, the chance causes of yesterday become the assignable causes of tomorrow.

A Discussion of the Applicability of Control Charts to Glass Container Production. *By J. H. Toulouse, Owens-Illinois Glass Company.*

The quality control chart technique uses as the model of perfect control the so-called "normal distribution" which is graphically represented by the normal frequency curve, or Gauss curve, shown in Fig. 1. Its abscissae represent here

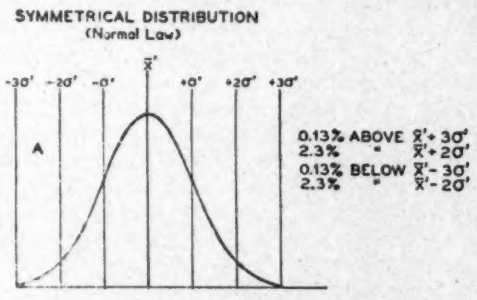


Fig. 1.

the values of a certain quality characteristic observed on the individual units of a lot. Its ordinates represent the respective frequencies with which these quality values (observations) occur in the lot. The area included between the curve and the horizontal axis represents the total number

of observations. A mathematical property of this curve is that approximately 99.73 per cent of the total observations fall within two limits located from the central line $\bar{X}'$ at equal distances $3\sigma'$ in which σ' is the standard deviation of the observations from the central line. Such limits are called "3-sigma" limits.

The author has made measurements of various quality characteristics of glass containers in order to see if the data so obtained is statistical in character and follows the normal frequency curve. In this respect it was found that glass container data is similar to the data obtained in many other fields which have been treated statistically. Data, on weight, thickness and other dimensional properties, impact strength, thermal shock strength, and internal pressure strength were shown to follow the normal frequency curve (although some skewness was present.)

The type of information that can be obtained from a statistical analysis of past production data was illustrated and several possible applications of control charts were discussed.

Practical Control of Quality of Parts Made in Small Lots or Short Runs. *By J. Manuele, Director of Quality Control, Westinghouse Electric & Manufacturing Company.*

The various details in connection with the actual operation of control charts were discussed from a practical point of view. These included (1) the size of sample necessary to get the center line and the standard deviation for the initial setting of a tool; and (2) the most economical initial setting when tool wear is anticipated; (3) the relations of the initial setting to the specification; and (4) other details. Actual plant control charts were shown.

Numerous lantern slides were shown to indicate the inspection and rechecking stations and other ramifications of a genuine system of control throughout the fabrication and assembly of typical products. The relation of quality supervision to production was discussed.

This paper appears in full in another section of this issue of THE GLASS INDUSTRY.

Application of Control Charts to Daily Glass Density Measurements. *By Dr. L. G. Ghering, Preston Laboratories.*

Statistical control charts are applicable to daily density or specific gravity measurements regardless of whether they have been made by the Archimedes or the Sink-Float method. Such charts provide a definite measure of variability and a rational sub-grouping of the daily density values gives clues as to where the variability exists in the process, i.e., whether in the raw materials, batch house, furnace, or the measurements themselves. The 3—sigma control limits on the Range chart and on the Daily Density chart distinguish chance variations, i.e., statistical fluctuations, from assignable cause variations. The use of the 3—sigma limits as action limits keeps all trouble shooting on the right track, and a search for trouble is made only when a lack of statistical control is indicated, i.e., when the chart indicates that the variation is unusual and an assignable cause must certainly exist.

The yardstick used as a measure of variation is the 3— day range of density on a particular furnace, the range being the spread of three consecutive daily densities. This is the rational sub-group sample for batch house variations and is the method recommended when the predominant variation is in the batch house. The average range ($\bar{R}$) was found to be 0.0006 to 0.0023 for 10 furnaces in 6 different plants. The corresponding 3— sigma limits for the daily density values are $\pm$ 0.0011 to $\pm$ 0.0040. These are applied to the center line value. These limits are equivalent to $\pm$ 0.09 to $\pm$ 0.31% silica replacing lime. In most of the 10 furnaces the average 3— day range of density was not over 0.0012 or 0.0013.

The method of analyzing past data and setting up the control chart and its limits was given in detail, including the use of density difference factors for the computation of the center line when the composition of the glass is changed. The actual operation of control charts for 4 furnaces was illustrated. About 20 assignable causes were indicated on the charts. For about half of these, the causes were found and corrected, the density subsequently coming back into control. In other instances the cause was found but no action was taken. Most of the assignable causes were traced back to errors originating in the batch house scales.

It was concluded that the 3— day range of density is a powerful tool for studying related quality characteristics (a fair degree of correlation being found between 3— day range and quality characteristics such as cord and checks) and should be helpful to management for striking an economic balance between tonnage pulled, glass quality, ware quality, and capital expenditures for improvements (especially improvements in the batch house or changes in the raw materials). The density control chart method was recommended for immediate adoption by all plants. For each furnace about 1 day's time is required for past data analysis and setting up the chart, 1 minute each day for plotting points and up to 1 hour each week for adjustments, analysis, and review.

Demonstration of Sampling Fluctuations in Drawings from a Bowl. *By J. H. Toulouse, Owens-Illinois Glass Company.*

Dr. Toulouse demonstrated the use of a bead box in solving sampling problems. The demonstration was interesting and instructive. A lot of beads was constructed which was known to contain a certain percentage of defectives (different colored beads). Various sample sizes were taken by the means of sampling paddles and the number of the defectives were counted in each sample and each sample size. It was shown that small samples taken from a moderately defective lot of articles are better than the lot more frequently than they are poorer than the lot.

The demonstration also showed the difference between sampling the product and sampling the process. Even with a fairly large sample very little could be said about the lot but if the samples had been used for testing the process by quality control methods, the successive samples would have been in control and would have indicated that the process had not changed.

Research of Glass Science, Inc. *By W. A. Weyl, Director.*

In founding an institute devoted to fundamental research in the field of glass one is confronted with two major difficulties. First, most of the knowledge and experience which are also responsible for the progress made in glass research are vested in the industrial research laboratories. Second, glass technology, like other branches of Ceramics, has many border-line sciences from which experience has to be drawn. It is not possible that one man can master all these essential sciences such as chemistry, physics, petrography, mineralogy, and even such special fields as spectroscopy and x-ray analysis.

The first difficulty can only be overcome by actual collaboration between the Research Institute and the research directors of the sponsoring industries. This problem has been solved by appointing a Research Committee where each of the sponsoring companies is represented. In meetings at regular intervals members of the Research Committee, as well as other scientists from the sponsoring industries, exchange their ideas on scientific problems among themselves and with the scientific staff of Glass Science. The second difficulty has been overcome by appointing a group of outstanding scientists as consultants to Glass Science. Among these scientists are Dr. K. Fajans, Professor of Chemistry, The University of Michigan; Dr. H. Mueller, Professor of Physics, Massachusetts Institute of Technology; and Dr. R. Powell, Department of Chemistry, The University of Princeton.

The speaker pointed out how various problems were attacked in collaboration with these consultants and research departments of the sponsors. Some of these problems were connected with annealing of glass, viscosity of glass, the

(*Continued on page* 472)

ELEMENTARY PRINCIPLES OF CONTROLLING QUALITY OF PRODUCT DURING MANUFACTURING

By JOSEPH MANUELE

Director of Quality Control, Westinghouse Electric & Manufacturing Company

EDITOR'S NOTE: In the two preceding issues of *The Glass Industry* an article by J. M. Juran, "The A, B, C of Quality Control" appeared in two installments presenting the fundamentals and philosophy of the application of statistical methods to the control of quality of manufactured articles during production as distinguished from the screening out and rejection of defectives after they have been produced. However, plant application and the effectiveness of the method can best be understood by a study of actual case histories or specific applications. Although the following case history, originally presented at meetings of the Society of Mechanical Engineers and the Glass Division of The American Ceramic Society, is not on glassware we believe it does illustrate the arithmetical details in the treatment of data. These details are essentially the same, regardless of the quality characteristic measured or the nature of the particular product; and the present illustration, in fact, is believed to be almost wholly applicable to dimensions of glassware since it deals chiefly with dimensions. There are comparable dimensions, e.g., finish diameter, that are equally important in glass containers, and certain other types of glassware, where the application is expected to be comparable to that of metal craft products. Furthermore, the article is unique in that it discusses "short run," and is of particular interest to glass plants because, there too, job changes complicate the problem of quality control.

In recent years, there has been a considerable amount of interest in the control of quality of products during manufacture as against the older philosophy of making products and subjecting them to rigid inspection afterwards. There is good business sense behind the policy of controlling quality during manufacturing. It reduces rejects to a minimum; it secures maximum production from available equipment; and it assures lowest unit costs.

In a good many instances, the statistical method of controlling quality is used. This method is very clearly described in the current literature on the subject—of which there is a considerable amount. However, for the beginner, it might be well to advise that he confine his applications to methods described in the American War Standards "Z1.1" and "Z1.2" issued in 1941, and "Z1.3" issued in 1942 by the American Standards Association.

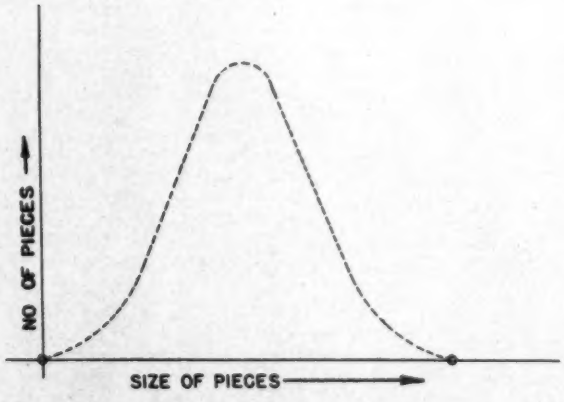
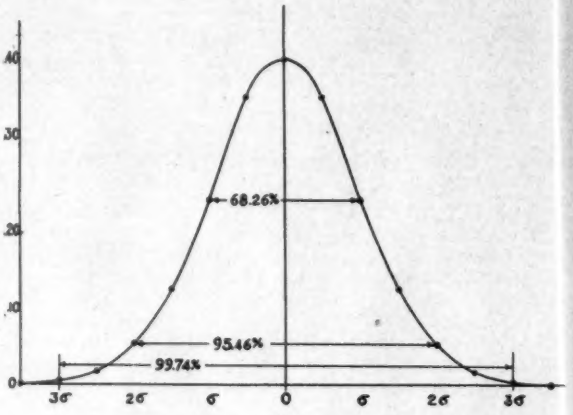


Fig. 1.



NORMAL CURVE OF EXPERIENCE

Fig. 2.

It is not necessary that the inspector be familiar with the Laws of Probability, or the fundamental mathematical concepts involved, in order to apply the statistical method to the control of quality. Any shop man knows that if he were to set up an automatic cut-off saw, to cut off pieces of 1 in. length from bar stock, the pieces would not all be 1 in. long, and that probably no piece would be exactly 1 in. long. He knows that if he were to measure all of the pieces, then plot a curve showing the number of pieces of any length, he would get a distribution similar to that shown in Figure No. 1.

This same distribution will be obtained from observations on any qualia, whether the products are the result of automatic machine operations, or whether they be the result of hand-assembly operations.

The mathematician knows that if the process is under what he terms statistical control, the frequency distribution curve will have certain characteristics. He knows that 68.26 per cent of all observations will fall within one standard deviation of the mean; he knows that 95.46 per cent of the observations will fall within two standard deviations of the mean; and that 99.74 per cent of the observations will fall within three standard deviations of the mean. This is shown in Figure No. 2.

Therefore, if it is desired to adjust a process so that it will produce no rejections, it is necessary that parts coming from such a process be distributed similar to the distribution shown in Figure No. 2. Furthermore, it is necessary that this distribution fall within the specification limits.

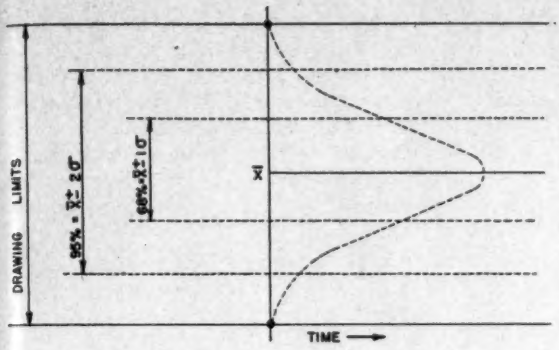


Fig. 3.

If we were to take the distribution curve shown in Figure No. 1 and rotate it 90°, we would have a curve resembling Figure No. 3. If we could arrange to have this curve completely within the drawing or specification limits, then we should expect no rejections from the process.

Two features must be noted in Figure No. 3. We could have rejections from the process due to one, or both, of two causes; first, if the mean of the process were not near the nominal specification value, we might have parts rejected, because of being oversize or undersize, depending in which direction the mean were displaced, with reference to the nominal dimension. The second cause for rejections might be due to inability of the process to repeat consistently. This would give a large standard deviation, causing the tails of the curve to fall outside the specification limits.

The mean of the process is determined by the setting or adjustment of the process, and is within the skill of the operator to control. The size of the standard deviation, or the length of the base of the curve, is a measure of the ability of the process to repeat consistently. If these two points are kept in mind, it will be easier to locate trouble, when trouble is indicated. A study of Figure No. 3 will make this point clear.

Let us take an automatic screw machine and proceed to set it up for production according to these principles. Let us assume that we are to make part No. 53-A-840-5. This part is a rivet which has a diameter of .125 in. to .126 in. The machine setter will proceed to set up the machine in the conventional manner, and, when he is satisfied that the machine is producing properly, he calls the inspector, and the inspector proceeds to check the setup according to statistical control methods.

The inspector takes a sample of fifty pieces and measures and records the diameter of each piece. He then calculates the mean and the standard deviation for these fifty pieces. The data and calculations are shown in Figure No. 4. It will be noted that the mean is .1245 in. and the standard deviation is .000495 in.

From this information, he charts the frequency distribution curve shown in Figure No. 5. It will be noted that a very small percentage of the parts fall within the drawing limits. A study of this curve shows that the machine needs to be reset, to bring the average of the process nearer the mid-point of the drawing limits. It also shows that the process is not repeating with sufficient consistency and, therefore, the spread of the distribution is much wider than the spread allowed by the drawing limits. This means that the tools should be resharpened.

The machine setter is advised of these conditions and, after he has made the required corrections, the inspector takes a second sample; this time only twenty pieces. From these twenty pieces, he calculates the mean and the standard deviation as previously. It will be noted now that the mean is .1250 in., and the standard deviation is .000127 in. The data and calculations are shown in Figure No. 6.

He then constructs a frequency distribution curve based on these values, which are shown in Figure No. 7. It will be noted that 50 per cent of the parts are undersize. The machine must be adjusted further to bring the average of the process nearer the mid-point of the drawing limits. It is also noted that the standard deviation is still too large.

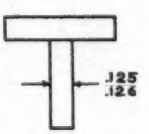
The machine setter proceeds to reset the machine, and he also attempts to dress up the cutting tools, in an effort to achieve greater uniformity of product.

The inspector takes another sample, this time taking only ten pieces. It might be stated, parenthetically, that a sample of ten pieces is too small under ordinary conditions. We have found that to determine the approximate distribution of a process, we must have a sample of twenty-five to fifty pieces. A larger sample, of course, is more informative, but a sample less than twenty-five pieces must be looked upon with suspicion.

The data and calculations from a sample of ten pieces are shown in Figure No. 8. It will be noted that the mean is now .1255 in., and the standard deviation is

FIRST SETTING
PART #53A840-3
MACHINE #49060

NO.	"X"	$X-\bar{X}$	$d^2 \times 10^{-8}$
1	.1248	+0003	9
2	.1251	+0006	36
3	.1245	.0000	0
	.1252	+0007	49
		0005	50
46			
47	.1248	+0003	
48	.1248	+0003	9
49	.1244	-0001	1
50	.1249	+0004	16
ΣX	6.2250	Σd^2	122×10^{-8}



AVERAGE $= \bar{X} = \frac{6.2250}{50} = .1245$

STANDARD DEVIATION $= \sigma = \sqrt{\frac{122\times10^{-8}}{50}} = .000495$

Fig. 4.

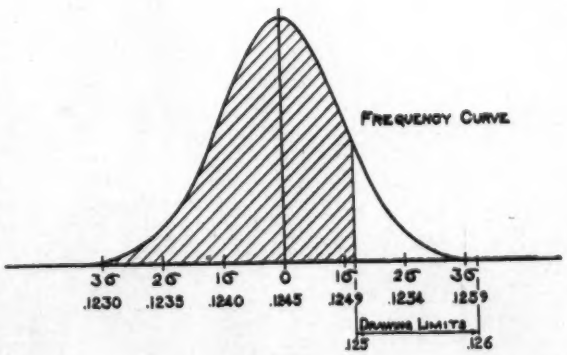
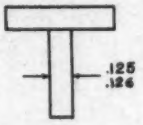


Fig. 5.

SECOND SETTING
PART #53A840-3
MACHINE #49060

NO.	"X"	$\frac{d}{X-\bar{X}}$	$d^2 \times 10^{-8}$
1	.1250	.0000	0
2	.1250	.0000	0
3	.1249	-.0001	1
4	.1250	.0000	0
		+.0001	1
16	.12[illegible]		
17	.1252	+.0002	
18	.1248	-.0002	4
19	.1251	+.0001	1
20	.1251	+.0001	1
ΣX=	25004	Σd^2=	32×10⁻⁸



AVERAGE $\bar{X} = \frac{25004}{20} = .1250$

STANDARD DEVIATION $\sigma = \sqrt{\frac{32\times10^{-8}}{20}} = .000127$

Fig. 6.

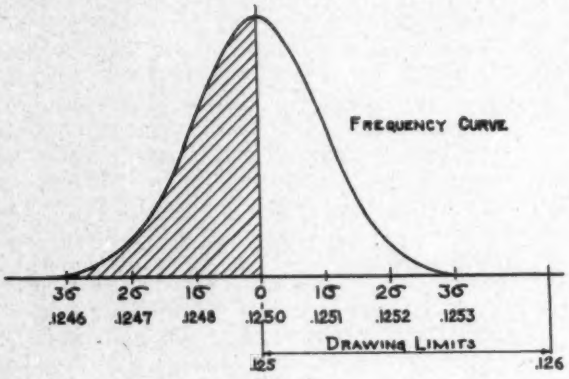


Fig. 7.

THIRD SETTING
PART #53A840-3
MACHINE #49060

NO.	"X"	$\frac{d}{X-\bar{X}}$	$d^2 \times 10^{-8}$
1	.1255	.0000	0 × 10⁻⁸
2	.1256	+.0001	1 × 10⁻⁸
3	.1255	.0000	0 × 10⁻⁸
4	.1255	.0000	0 × 10⁻⁸
5	.1255	.0000	0 × 10⁻⁸
6	.1255	.0000	0 × 10⁻⁸
7	.1254	-.0001	1 × 10⁻⁸
8	.1254	-.0001	1 × 10⁻⁸
9	.1255	.0000	0 × 10⁻⁸
10	.1257	+.0002	4 × 10⁻⁸
ΣX=	12551	Σd^2=	7×10⁻⁸

AVERAGE $\bar{X} = \frac{12551}{10} = .1255$

STANDARD DEVIATION $\sigma = \sqrt{\frac{7\times10^{-8}}{10}} = .000268$

Fig. 8.

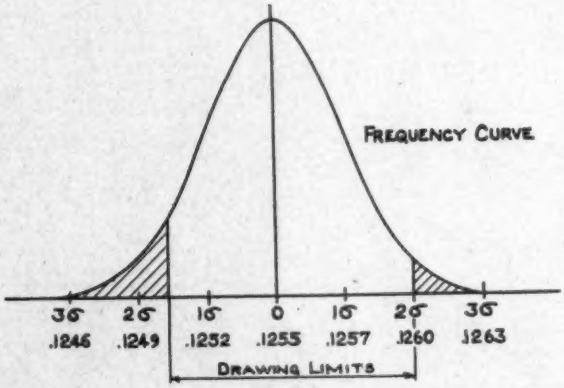


Fig. 9.

.000268 in. The frequency distribution, based on these values, is shown in Figure No. 9. The machine is now set at the correct point for the production of a minimum amount of rejections. However, the standard deviation is too large. A few pieces will be produced which will be oversize, as shown by the shaded area at the right. A somewhat larger percentage of parts will be produced, which will be undersize, as shown by the shaded area at the left of Figure No. 9.

We now have two alternatives. We can take the tools out and attempt to dress them up to improve the keenness of the edge, in an attempt to achieve greater uniformity of product. The second alternative is to allow the operation to run and to pick out later the defective parts by detail inspection. From the experience we have gained in setting up this machine three times, it appears that the cutting tools cannot be improved. There is probably something inherent in the machine which produces this lack of uniformity. This might be loose bearings, excessive vibration, lack of uniformity in the bar stock, or any other of a number of factors. However, it appears that we have adjusted this particular operation about as well as we can under the circumstances. Further improvement requires an inspection of the machine itself, to determine the cause of the wide variability between parts.

Figure No. 10 shows a control chart used for controlling the quality of parts coming from automatic screw machines. A careful study of this control chart shows a vast amount of information. The log at the top of the chart shows when tools were ground or adjusted, and when the machine was down for any purpose.

In constructing this control chart, the mean $(\bar{X})$ for the process and the drawing limits were first plotted, then a line was drawn at a distance of three standard deviations below the upper drawing limit, and another line was drawn at a distance of three standard deviations above the lower drawing limit. The operator is given instructions to allow the machine to run as long as no parts fall within the areas bounded by the extreme drawing limits and each of the three standard deviation lines. The drift or trend of the mean is due to tool wear and is of no particular concern until parts begin to fall above the upper three standard deviation line. At that point the machine is shut down and tools are ground.

The setting of limits in this manner is considerably more severe on the operation than setting of limits in the conventional manner. However, it has certain other advantages.

It is easy to explain to the operator that at any time when we take samples of five pieces what we are really doing is taking five pieces from the distribution, similar to that shown in Figure No. 3. Therefore, we can really assume that what we have is a series of distribution curves spaced one hour apart so that the frequency distribution curve for six o'clock would have its mean on the three standard deviation line, and its upper tail would be touching the upper drawing limit. By shutting down the machine at six o'clock and sharpening the tools, we are assuring ourselves that no parts will be made outside the upper drawing limits. Theoretically, we could have allowed this operation to run another hour or two, but, in order to have absolute certainty that no rejections will be produced, we forego this extra hour's production.

A study of the chart shows what has happened during

the entire run. Two things stand out—one is that long runs at full productive capacity are possible, if the setups are properly made; the second point is that machines should not be stopped for any reason as long as parts are being made within control limits. By this method of establishing control limits, maximum length of runs are achieved.

These charts are kept at the machines and the operator is allowed to take samples and measure them. However, the decision as to when an operation shall be stopped for making adjustments or grinding tools, rests with the inspector, who calculates and constructs the chart.

The idea appears to be prevalent that when we speak of control of quality during manufacture statistical methods are always implied. This is not the case. We have been able to control quality at Westinghouse without using statistics. It must be borne in mind that the statistical method, while desirable, is a rather expensive tool, requiring trained personnel. It also is rather difficult to explain to people who do not possess the proper mathematical background. However, the fundamentals of this method can be retained, if we are willing to operate with very small samples—say samples of one piece. Then the method resolves itself into "first piece and patrol inspection."

When quality of product is being controlled by means of "first piece and patrol inspection," the machine, or process, is set up and adjusted in the conventional manner. After a sufficient number of pieces have been produced to give assurance that machine operating conditions have reached stability, the operator informs the inspector, who performs the "first piece inspection."

Fig. 11.

This method applies to machining operations on parts as well as assembly operations on the completed equipment or on sub-assemblies.

The inspector proceeds to make a complete and thorough inspection of the part or assembled equipment. This inspection goes beyond the specifications or tolerances applying to the part at this particular stage of production. The inspection at this point includes all features of quality affecting the part, such as kind and grade of material used, condition of burrs on cut or sheared edges, condition of machined surfaces to determine whether they are sufficiently smooth or not, hardness of material where this

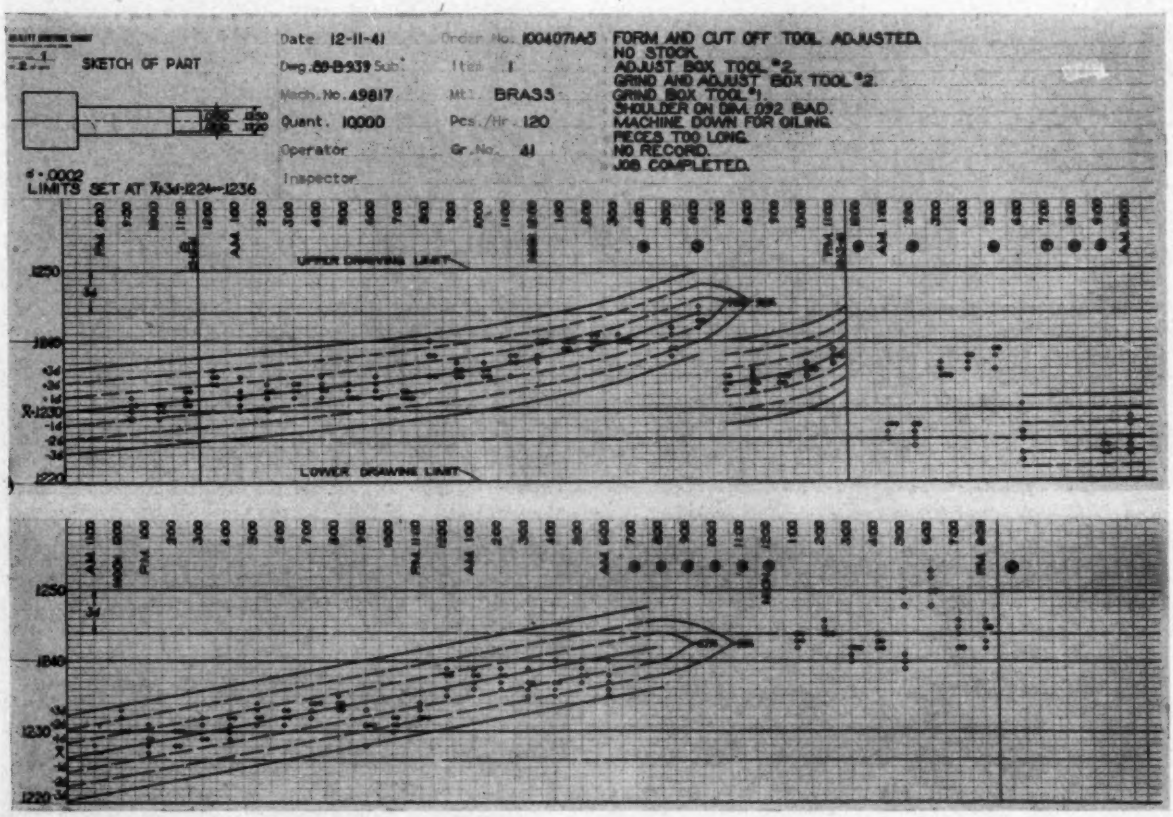


Fig. 10.

can be determined, general appearance of the parts or assembled item, and complete compliance with drawing or specification requirements. This is essentially a bench inspection, and the inspector must be equipped with the tools required for performing this inspection. Figure No. 11 shows an inspector performing first piece inspection on a punch press item.

It might be stated in passing that by this method dimensions on blanked and formed parts produced on punch presses are being held to within .001 in. regularly.

If the inspector is satisfied that parts or assemblies are within the required specifications, and that the process or machine itself is in such condition as to continue to produce good parts, he makes out an Operation Inspection Tag, as shown in Figure No. 12. On this tag he records the part number, the shop order, and the name of the operation. He also describes briefly the material being used; in this case cold rolled steel, Specification No. 7598-3. Any peculiarities of the material, such as hardness, is also shown on this tag, as an indication that the inspector has checked it. The inspector also shows the time and date of this first piece inspection, and the shop section in which the operation is being performed. In this case, the first piece inspection was performed at 8:20 A.M. February 13, 1940, in Shop Section MO-34.

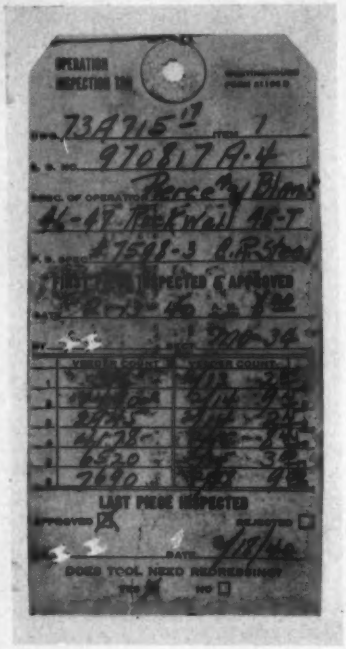


Fig. 12.

The inspector either signs his full name or punches the tag with his identifying punch. If he uses a punch, it is understood that no other inspector has a punch of the same design.

The tag, properly made out, and the piece which has been approved, are both returned to the operator as his authority for proceeding with the operation. The tag must be prominently displayed at the machine or work area, where the operation is being performed. No operation is allowed to run unless this tag is shown, except while the machine is being set up or adjusted. Figure No. 13 shows a battery of brazing machines. The operation inspection tags are plainly visible on the machines directly in front of the operators.

After the operation has been in process for some time, and at the discretion of the inspector, he visits the machine or work area, to determine whether manufacturing conditions are still satisfactory for the production of parts or assemblies of the required quality. When the inspector approaches the operation, he stands back and observes general working conditions. Figure No. 14

Fig. 13.

shows the inspector making such patrol inspection. He notes first whether the machine is properly lubricated, clean, and in good general working condition. He notes whether the operator is subject to excess fatigue, poor ventilating or lighting conditions, or whether or not parts are being placed in suitable containers. He notes whether the scrap is being properly taken care of, or whether it is allowed to fall on the floor, creating an accident hazard.

All of these factors affect the operator's peace of mind, and general morale, and contribute substantially to the production of a proper standard of quality.

If these general conditions are satisfactory, the inspector proceeds to inspect one or more pieces, to satisfy himself that these are of substantially the same quality as those checked at the time of first piece inspection. It

(*Continued on page* 466)

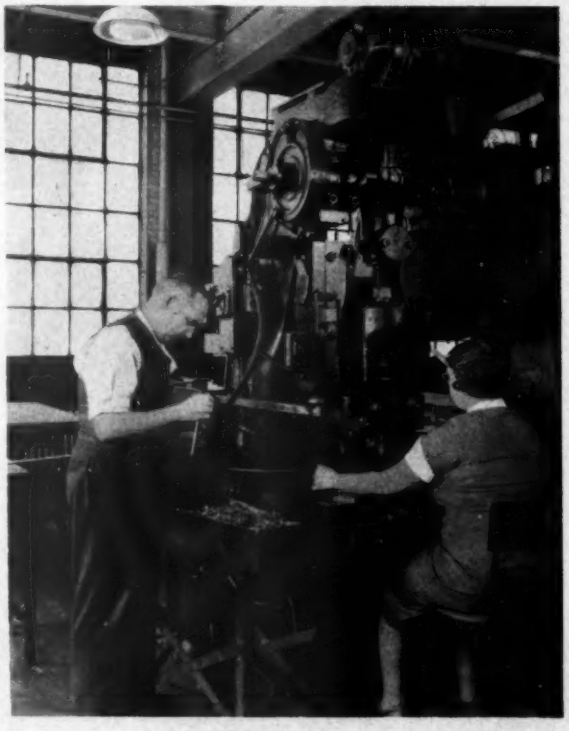


Fig. 14.

IMMEDIATE AND FUTURE PROBLEMS DISCUSSED AT GCA FALL MEETING

The two day Fall Membership Meeting of the Glass Container Association was called to order at the Hotel Biltmore in New York Thursday morning, September 28, and strict adherence to the carefully layed out schedule of discussions enabled the glassmen to complete their program as planned.

Since much of the discussion was of a strictly membership nature a detailed account of the proceedings cannot be given in this report. However, it can be stated that problems concerning the glass container industry's future plans for post-war operation were fully discussed and definite progress was made in the direction in which the industry has pointed its sights.

After Victor L. Hall outlined the potentialities of the broad industry program, other speakers submitted their views and recommendations in support of coordinated industry planning.

On the second day of the meeting several speakers contributed illuminating information on various phases of the glass container industry's operations and problems.

B. H. Taylor, Traffic Director of the Association, presented some interesting thoughts in his talk "Post-War Transportation Prospects." Mr. Taylor outlined the embryonic plans of certain groups, calling for the revamping of the nation's transportation facilities. One group, for example, sponsors the idea of an integrated transportation service which would make it possible for a single company to provide all types of service, to meet all transportation requirements and to include all types of transportation whether it be rail, highway, water or air. It was further stated there is another equally articulate group opposing such thinking on the theory that such a program would tend to create a monopoly through a super-efficient set-up, thereby stifling progress which naturally results from competitive enterprise.

Other examples of controversial thinking were cited by Mr. Taylor. However, as he stated, "despite all of these maneuvers, some of which at least seem to stem from political considerations rather than economic ones, the outlook for the post-war transportation picture is conceded to be bright."

Referring specifically to the transportation situation as it concerns the glass container industry, Mr. Taylor stated that the Office of Defense Transportation order requiring loading of freight cars to full capacity, subject to minor exceptions, has resulted in making available some 120,000 additional cars monthly and the average per car loading of glass containers has increased approximately five and one half tons since the order became effective.

The railroads have benefited greatly by this development and favor the retention of all or most of the system. Discussing the freight situation broadly, Mr. Taylor pointed out that one factor which must be considered is whether or not it will be possible to sell products under normal conditions in carload units in excess of the present Tariff minimum.

Space does not permit a detailed account of the various complex phases of transportation as they may effect the container industry. However, it can be stated that these problems are receiving full attention and efficient handling by the Traffic Director.

The presentation of the industry's statistics was handled by R. L. Cheney, the Association's genial and capable Pacific Coast Manager.

An innovation in the statistics usually presented was the inclusion of a chart and table showing the production and shipments of monthly figures by moving years. This method of plotting the monthly figures eliminates the influence of seasonal factors. The chart and table showing these moving year figures accompany this article.

Another interesting combination of chart and table statistical data presented to the membership is the chart showing Total Annual Industry Production compared with Productive Capacity and Total Production by Months, and the table giving the Annual Production Compared with Productive Capacity 1929-1944. This chart and table are also reproduced in this report.

Following the presentation of statistics, Dr. L. G. Ghering of the Preston Laboratories explained in detail the technical work being carried on in Butler in the interests of the container industry. While THE GLASS INDUSTRY has, over a period of time, devoted much space to this type of work it is felt that the publication in full of Dr. Ghering's talk is desirable since it explains various researches carried on by Preston Laboratories as they affect glass making operations and because it was prepared for and delivered to the non-technical administrative heads of the industry. Dr. Ghering's paper appears at the end of this article.

At the conclusion of the meeting, the glassmen enjoyed a most interesting address by Captain Hugh Laughlin, U.S.A.A.F., formerly associated with the Anchor Hocking Glass Corporation.

As Captain Laughlin stated in his opening remarks, his talk was far removed from glass but nevertheless he gave the assembled glassmen much food for thought in his presentation of some amazing facts concerning the readjustment program of the Army Air Force as it affects material and manufacturing operations.

GCA RESEARCH AND SERVICE AT THE PRESTON LABORATORIES

Gentlemen, as you know, there have been two GCA research projects in Butler; Standard Testing Procedure Research (myself) and Cord Research (Dr. Knight). A third project, Impact Research, was added recently. Dr. Glathart, a physicist, was hired last month. At the present time there is only one assistant on full time GCA research but others contribute on a time card basis.

This work is directed by the Standard Testing Procedure Committee, five technical men from five companies, who suggest work, review the work done, define the scope of the work that can be effectively done on an industry-wide basis and make appropriate recommendations to your Board of Directors. This committee meets regularly four times a year. Their method of re-

porting to you is through the GCA Technical Bulletins. These are usually prepared by the Laboratory and consist of reports, reprints of our research published in the technical press, and reprints of pertinent work done in other laboratories.

Mr. Hall has a mailing list of over 300 including you gentlemen and your technical men. Of course, these reprints and detailed reports are technical in character and sometimes not of immediate application in the actual production of bottles. But, in any case, the detailed information is made available to you and we usually write a covering letter, giving you an idea of the content and its immediate application, if any. Your job then is to get the information into the right hands, within your company.

About three years ago the Main Technical Committee appointed a Technical Sub-Committee to do the spade work and detailed technical work that can be done on an industry-wide basis. The Main Committee is a policy committee, which keeps in mind the over-all picture. The Sub-Committee meets separately and works on details, as they did on the polarizing microscope section test, the subject of a recent bulletin. In work like this, it is an advantage to have the experience and comparison of results and information of several laboratories.

The Laboratory Staff numbers about twenty-four at the present time, excluding some seven or eight in the armed forces. An outline description of the activities of the Lab appeared in THE GLASS INDUSTRY, January, 1944.

At the laboratory, apart from our main interest in glass containers, Dr. Preston is doing work for the flat-glass industry, and for the fiberglas industry. Here we become involved also with plastics, and the combination of glass fibers with plastics, to make exceptionally strong materials of extraordinarily light weight. The light-weighting program for bottles has been a great success, and has helped both the industry and the country in this time of shortage; but light-weighting is equally important in airplane structures. It is not impossible that this may react favorably on glass containers. Interactions such as these are difficult to predict, but make it advisable to keep up a broad interest, and a broad field of effort, not too specialized and limited.

The Standard Testing Procedure Research, the project that still best describes and includes the other part of my own work, is actually about half research and half service. Originally, the most important service was the defense of personal injury claims arising from broken bottles. Other specific services for various companies are illustrated by the following:

(*Continued on page* 470)

MOVING YEAR PRODUCTION AND SHIPMENTS

January 1941 thru August 1944

PRODUCTION

Moving Year Ending:	1941	1942	1943	1944
January	54,714,348	73,077,066	79,801,378	94,460,283
February	54,942,590	74,706,128	80,529,689	95,504,483
March	55,447,405	76,550,901	81,202,990	96,739,976
April	56,160,703	78,173,919	81,972,368	97,601,181
May	57,688,464	79,138,539	82,960,619	98,256,167
June	59,440,104	79,700,092	84,077,109	99,347,900
July	61,030,550	79,313,196	85,848,361	99,666,611
August	62,838,953	79,071,270	87,562,589	99,987,612
September	64,945,063	79,055,452	88,850,286	—
October	67,101,507	78,911,680	90,618,116	—
November	68,950,183	78,945,548	92,242,799	—
December	70,817,198	79,182,790	93,665,657	—

SHIPMENTS*

January	53,847,750	72,579,162	81,948,514	97,482,018
February	54,300,404	74,529,434	82,824,654	97,969,774
March	55,201,256	76,527,470	83,934,005	98,157,824
April	56,455,043	77,817,619	85,242,159	98,392,735
May	58,139,938	78,387,002	86,674,333	98,785,527
June	59,838,659	77,776,736	88,673,806	98,930,226
July	61,777,318	77,658,669	89,995,332	99,043,743
August	64,033,550	77,682,809	91,160,524	99,500,750
September	66,531,616	77,567,592	91,950,308	—
October	68,017,714	78,228,926	93,544,781	—
November	69,268,936	79,154,520	95,341,815	—
December	70,780,151	80,667,394	96,655,434	—

* Includes Domestic and Export

INDUSTRY DATA ON SHIPMENTS, PRODUCTION AND STOCK

(Millions of Gross)

ANNUAL PRODUCTION COMPARED WITH PRODUCTIVE CAPACITY 1929-1944

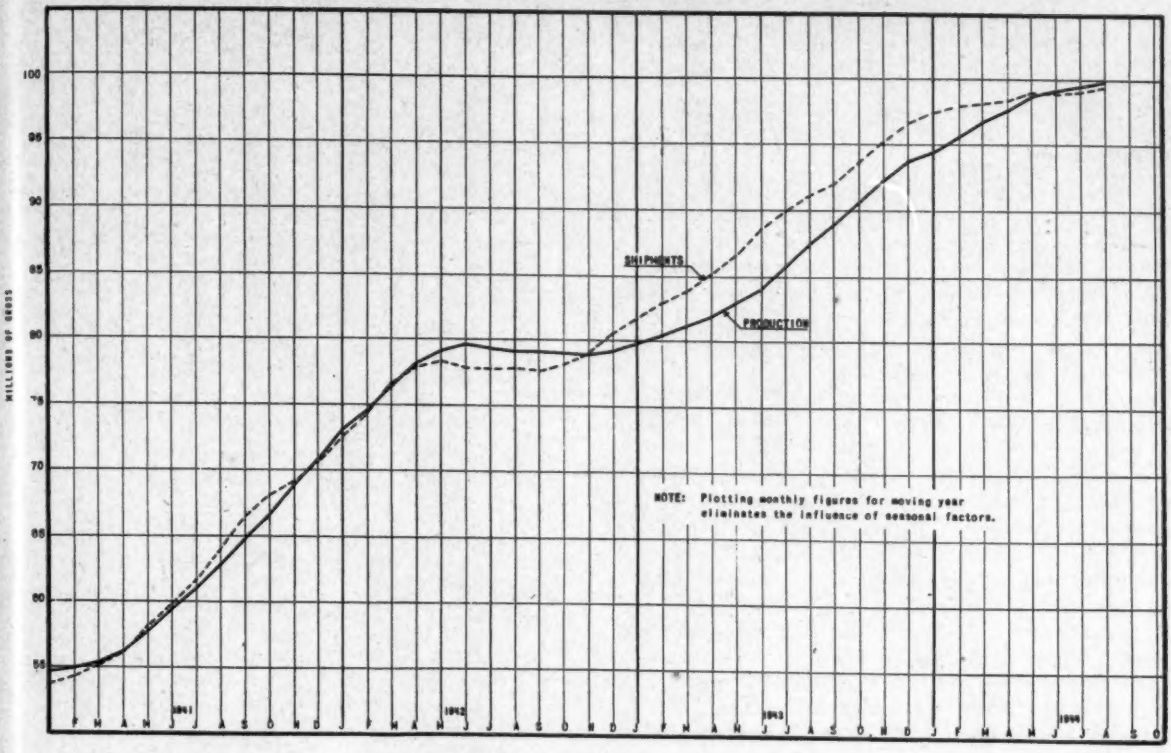
	Active Capacity 6 Day	Active Capacity 7 Day	Annual Production	% 6 Day	% 7 Day
1929	57.1	—	—	—	—
1930	56.0	—	—	—	—
1931	56.1	—	—	—	—
1932	56.4	—	26.6	47.2	—
1933	57.9	—	33.5	57.9	—
1934	61.4	—	35.8	58.3	—
1935	65.6	—	38.8	59.1	—
1936	67.4	—	45.3	67.2	—
1937	70.8	—	53.0	74.9	—
1938	73.8	—	43.4	58.8	—
1939	77.4	—	51.5	66.5	—
1940	79.8	—	54.5	68.3	—
1941	79.9	—	70.8	88.6	—
1942	80.5	95.4	79.2	98.4	83.0
1943	78.2	92.8	93.7	119.8	101.0
1944	82.6	98.3			

AVERAGE MONTHLY CAPACITY (ACTIVE)*

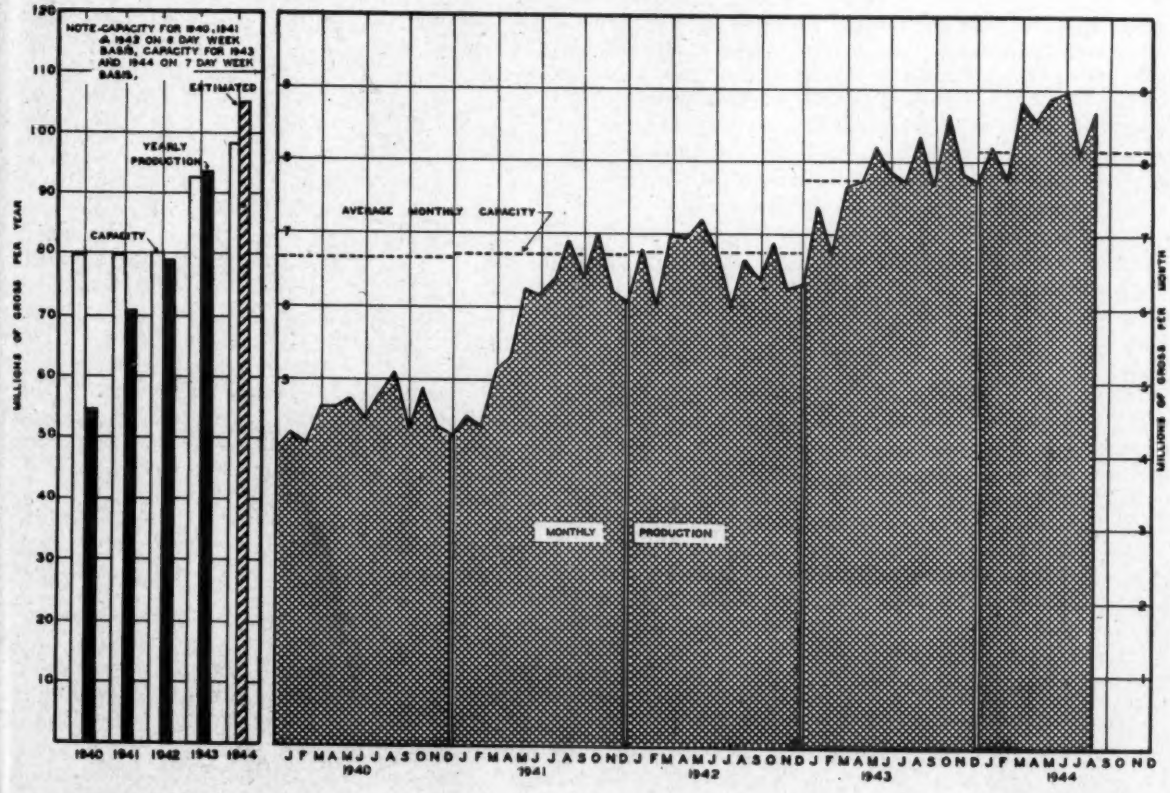
1940	1941	1942	1943	1944
6.654	6.659	6.708	7.731	8.190

* 1940-1942 6 days per week basis 280 operating days
1943-1944 7 days per week basis 332 operating days

PRODUCTION AND SHIPMENTS BY MOVING YEARS ENDING MONTHLY
1941-1944



TOTAL ANNUAL INDUSTRY PRODUCTION COMPARED WITH PRODUCTIVE CAPACITY
AND TOTAL PRODUCTION BY MONTHS



INVENTIONS AND INVENTORS

A Summary of United States Patents of Interest to the Glass Industry Issued During August

Compositions

Carl J. Harbert of Shaker Heights, O., and R. F. Morrison of Elyria, O., assigned to The Harshaw Chemical Co. two patents covering compositions for the production of alkali resistant enamels for glass decoration. Patent 2,356,317 involves the use of barium stannate, while barium zirconate is used in 2,356,316. Both patents deal with the same basic composition which preferably has the following composition range: lead oxide 40 to 60 per cent, silica 22 to 32 per cent, boric oxide 3 to 12 per cent, titania 0 to 5 and preferably 2 to 4 per cent, soda 3 to 7 and preferably 5 per cent, and cadmium oxide 0 to 5 per cent. When the alkali resistance is to be imparted by barium stannate the proportion is 6 to 14 per cent and preferably 10 to 12 per cent, and an addition of 0.5 to 2 per cent by weight of sodium fluoride is used. When barium zirconate is used the preferred amount is 5 to 15 per cent. They report that barium and zirconium oxides may be used instead of the compound of these two oxides.

M. E. Nordberg and H. E. Rumenapp have given Corning Glass Works a modified process for introducing color into glassware made by the now famous method wherein one of two glass phases is leached from a glass article leaving a porous product of almost pure silica which is then heat treated to remove the pores. In a patent reviewed in the March 1944 GLASS INDUSTRY, 2,340,013, these inventors disclosed that they had been successful in introducing coloring agents into the glass while it was still in the porous state. These were provided as soluble salts, and it was found that there was frequently an advantage in also using aluminum nitrate since this allowed the development of good strong colors, where opacity might otherwise develop. In the latest patent 2,355,746 it is now revealed that the same function is served by compounds of phosphorus.

Feeding, Forming and Shaping

Fig. 1 is taken from patent 2,354,807 and illustrates the suggestion of John H. Fox and Wm. O. Lytle of Pittsburgh Plate Glass Co. for a continuous method of producing foam-glass. A supply of molten glass is drawn under a curtain wall into a foaming chamber where it is mixed with calcium carbonate or other gas producing solids injected into the bottom of the chamber by means of a screw conveyor. A series of electrodes 59 are provided at suitable points. As the foam is produced and the foamed glass moves upwards an impeller provided with paddles 66 contacts the upper layer and ejects it from the foaming chamber onto conveyors which complete the task of forming a continuous billet of foam glass.

Patent 2,355,036 granted to Walter K. Berthold of Rockville, Conn. (Hartford-Empire Co.) concerns transferring and conveying apparatus for removing formed ware from a receiving surface such as a cooling dead plate at a forming machine. It is so designed as to make it possible to engage the articles and place them on a moving delivery conveyor in relative positions which may be different from those occupied by the articles on the stationary platform.

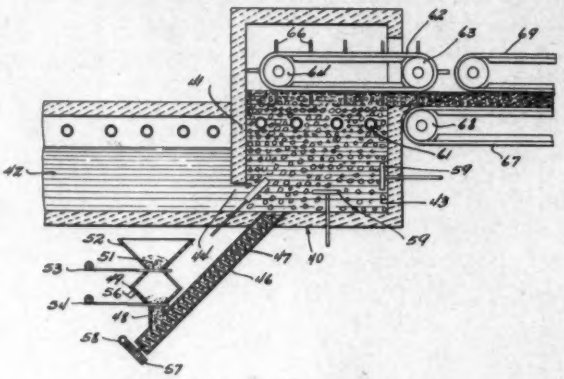


Fig. 1. 2,354,807 : Fox and Lytle. To form a continuous stream of foamed glass, calcium carbonate is forced into molten glass at the bottom of the foaming chamber and the cellular product is conveyed away by means of moving paddles.

The sealed edges of hollow glass blocks are sometimes fluted or otherwise figured so as to modify the light reflecting properties of these edges of the block, particularly to minimize glare. Another means of accomplishing this result is revealed by Henry H. Blau in patent 2,355,262, assigned to Corning Glass Works. He makes the block from opacifiable glass and opacifies only that part in the vicinity of the join. Suitable glasses which will develop opacity when heated for welding the two halves together are said by Blau to be described in his earlier patents 1,778,305 and 2,132,390.

Another Corning Glass Works patent is 2,355,597 issued to Leander N. Pond of Corning, N. Y., for apparatus for handling tumblers from a burn-off machine. Ordinarily there is danger of distorting the tumbler due to the softened edge where the moile has just been received, but in this machine it is received on a support which enters the interior of the tumbler and over which the tumbler is brought to rest when its inner bottom surface encounters the support, thus avoiding contact with the rim of the tumbler. The tumbler is then rotated through ninety degrees and gently brought to rest in a horizontal position on receiving units which rotate a further ninety degrees to bring the tumbler to rest in an upright position.

Miscellaneous Processes

Gordon L. Strubler of Corning, N. Y., discusses in patent 2,356,016 the problems encountered when attempting to coat articles with a layer of molten glass by spraying. His previous patent 2,085,278 had described apparatus which fed powdered glass to a burner which melted it and blew it onto the surfaces to be coated. So considerable a period of residence within the heating

chamber was required that this chamber needed to be over four feet long and the apparatus was unwieldy. Now, after studying the problem he has outlined principles which allow him to accomplish the job with an apparatus weighing only 25 pounds and with a fire chamber only 18 inches long. He made this progress by introducing a powdered combustible material with the powdered glass, and by raising the temperature. Previously when these higher temperatures had been used it was found that some of the alkali escaped from the glass and left it pitted. Now he provides what he calls an alkaline atmosphere in the fire chamber by adding a small percentage of alkali, such as one per cent soda ash, to the powdered glass.

A process for lowering reflection from optic surfaces is described in patent 2,356,553 issued to G. J. Weissenberg of Berlin, for which the rights are held by the Alien Property Custodian. The glass surface is first cleaned and is then wetted with an alkali silicate containing furfurol or dioxane, which is then dried and reacted with a strong acid such as hydrochloric to precipitate silicic acid which after washing and drying provides a transparent coating of silica.

During the use of enameled or glass-lined chemical equipment it frequently happens that a break will develop which allows the contained chemical to reach and attack the metal. S. W. Shepard and J. S. Magielnicki have developed a repair method, and the patent covering it, 2,355,474, has been assigned to American Cyanamid Co. Their method is to locate the break, and prepare a clean roughened surface extending through to the metal by sand blasting, and then to repair the break by applying a coating of gold or other precious metal through the burner of a metallizing gun. To finish the job a corrosion resisting organic film may be applied.

Other patents issued in August included 2,357,154 to Paul Wilhelm of Waterbury, Conn., for a lens grinding machine, and a group of four patents to Harry E. Stover of Long Island, N. Y., for machinery for sealing or capping containers. These patents are assigned to Anchor Hocking Glass Corp. and bear the numbers 2,355,478 to 3,355,481.

Sheet and Plate Glass

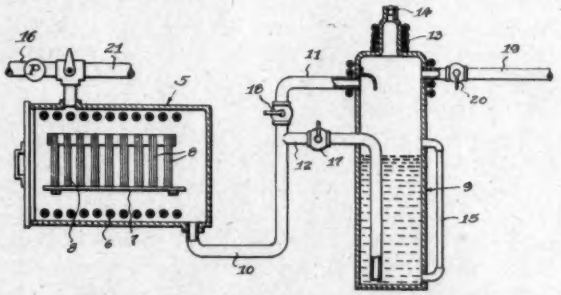


Fig. 2. 2,355,696 : Bartel. The bonding of laminated sheets 8 is accomplished in an atmosphere of acetone vapor which provides the necessary temperature and pressure.

Fig. 2 illustrates the method by which Floyd E. Bartell proposed in patent 2,355,696 to apply the required heat and pressure to laminated sheets by surrounding them with acetone vapor. The practice of compressing laminated glass while it is heated by immersion in liquid is

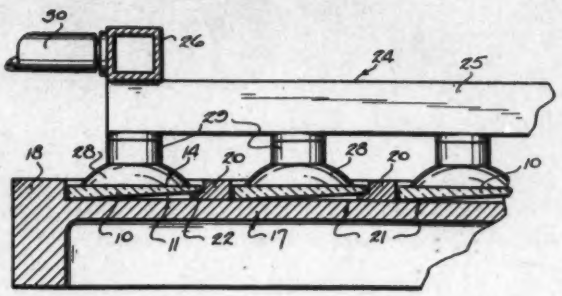


Fig. 3. 2,356,136 : Wampler. In a table for handling prismatic glass plates for rear-view mirrors the plates are held with a plane edge horizontal to provide an available surface for the contact of vacuum pads used for lifting.

familiar. What Bartell has done is to make use of a liquid which by heating will form a vapor which can be used for producing the desired temperature to heat the glass and the bonding material, and at the same time to give a vapor pressure which can be used as the source of pressure. When the sheets are joined by cellulose acetate a temperature of 140 degrees C. is a favorable temperature. Two liquids which at this temperature will develop such pressures as are needed for compressing the laminae are acetone and isopropanol. In the accompanying drawing the glass sheets to be joined have been clipped together and are shown at 8. Heating coils within this chamber are indicated by 6. The acetone or other suitable liquid is stored in the right hand tank which is equipped with cooling coils 13 so it may serve as a condenser. In applying the process, air is evacuated from the chamber holding the sheets and then acetone is allowed to enter the bottom of the chamber; heat is applied to vaporize the acetone and to raise the temperature to 140 degrees where the required pressure for curing will be developed. It will be noted that the organic vapors chosen for the pressure fluid should do no harm when they find their way into the plastic layer between the sheets of glass.

Roy W. Wampler of Toledo, (Libbey-Owens-Ford Glass Co.) received patent 2,356,136 for apparatus for handling the prismatic mirrors used for rear view vision in vehicles. The glass plates have a wedge shaped cross section and are handled on a table as illustrated in Fig. 3 which has longitudinal ribs 20 which hold the plane surface in a horizontal position to facilitate the application of vacuum cups 28 for lifting. Another Libbey-Owens-Ford patent is 2,356,433 granted to George R. Roesch and Gerald White of Toledo for apparatus for grinding the edges of glass plates.

Miscellaneous patents in this group included 2,357,206 granted to Norman H. Klages of American Window Glass Co. for apparatus to replace hand scoring in cutting the very thin sheets used for cover glasses, 2,356,877 to Alfred C. Oakes of Mount Vernon, O. (Pittsburgh Plate Glass Co.) for automatic apparatus for cutting glass sheet into panes, and two patents for means of mounting glass in the walls of vehicles. The latter patents are 2,356,123 issued to Edmund Speed of Pressed Steel Co. Ltd., Cowley, Oxford, England, and 2,365,878 to Frank F. Painter of Tarentum, Pa., and the Pittsburgh Plate Glass Co.

(*Continued on page 468*)

GJ Research Digest

Practical Interpretations of Glass Technology

Calculation of Surface Tensions of Glasses

One of the many physical properties of glass which has received much attention in literature during the past few years is that of surface tension. Various writers have discussed the effects of surface tension in the glassmaking process, the fining of glass, the persistance of cords, the corrosion of refractories, and the forming of the finished product, while other writers have reported on the effect of composition on surface tension.

K. C. Lyon (*The Journal of The American Ceramic Society*, June, 1944) has studied this latter data and has derived factors which will allow the surface tensions of glasses at temperatures of 1200° and 1400° C to be calculated from their compositions. The factors so derived are as follows, and represent the effect of 1 per cent oxide on surface tension of glass in which the ratio $SiO_2 : Na_2O$ exceeds 3.25:

	Dynes/cm.	
Oxide	1200° *C*	1400° *C*
SiO_2	3.25	3.24
Fa_2O_3	(4.5) *	(4.4)
Al_2O_3	5.98	5.85
B_2O_3	0.23	—0.23
CaO	4.92	4.92
MgO	5.77	5.49
BaO	(3.7)	(3.8)
Na_2O	1.27	1.12
K_2O	(0.00)	(—0.75)

The nine oxides so evaluated are those commonly found in significant amounts in glass compositions. Comparison of calculated and found values indicates that surface tension may be computed as an additive function of composition to within about 4 dynes per cm. at 1200° and 1400° C.

As the influence of surface tension in the glassmaking process becomes more well known these factors will in turn become more valuable as they allow the determination of surface tension changes in advance of contemplated composition changes.

Quality Control

The interest shown in the subject of quality control, as evidenced by the attendance at the Symposium on Refined Methods of Quality Control which was recently held by the Glass Division of the American Ceramic Society, indicates that this subject may be of increasing importance.

For those who are not familiar with the subject and may wish to obtain a working knowledge without resorting to the classical works such as Shewhart's "Economic Control of Quality of Manufactured Product," two publications of the American Standards Association may be recommended. These are: "Guide for Quality Control and Control Chart Method of Analyzing Data" and "Control Chart Method of Controlling Quality During Production." (These publications were mentioned in J. M. Juran's article on the "A, B, C of Quality Control" which was recently reprinted in THE GLASS INDUSTRY.)

The first two standards were published as a single pamphlet in 1941 (designated as Z1.1—1941, and Z1.2—1941) and the third standard was published in July, 1942 (designated as Z1.3—1942). Copies are available from the A.S.A., 29 West 39 Street, New York 18, N. Y.

Standard Z1.1—1941 under scope states that this standard is intended as a guide for handling problems concerning the economic control of quality of materials and manufactured products. It has particular reference to methods of collecting, arranging, and analyzing inspection and test records in a manner designated to detect lack of uniformity of quality.

Items discussed are 1—The Control Chart; 2—Specification Limits; 3—Control Limits; 4—Variation of Quality, Assignable Causes; 5—State of Control; 6—Practical Advantages of a State of Control; 7—Establishment of Control Limits; 8—Principal Uses of the Control Chart; 9—Use of the Control Chart for Judging Whether Control Exists; 10—Use of the Control Chart for Attaining Control of Quality, and 11—Cooperation Between the Technical Man and the Statistician.

The scope of the Z1.2—1941 standard states that this standard covers the control chart method of analyzing a collection of data, with particular reference to quality data resulting from inspections and tests of materials and manufactured products. The control chart method of analyzing data provides a graphical summary of the data that are being analyzed. This summary assists judgment in determining whether there is evidence of lack of control, and whether there is justification in using the summary as a basis for predicting the future performance of the processes that give rise to the data that are being analyzed—the performance, for example, of a production process.

The appendix to this standard gives formulas and tables useful in applying the control chart method of analysis and illustrates several examples of its usage.

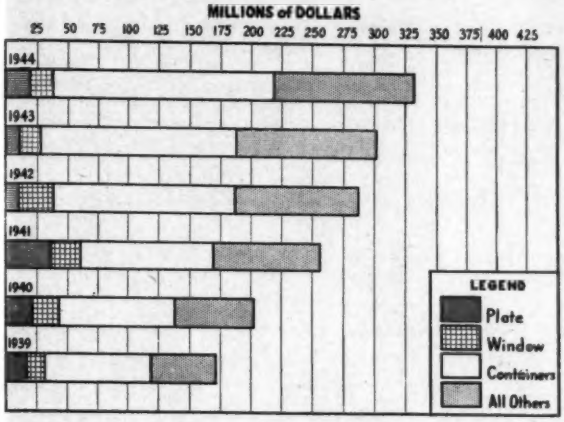
Standard Z1.3—1942 deals exclusively with the control chart method of controlling quality during production and describes in detail the preliminary steps in setting up a control procedure, how to start the control chart and how to use the control chart during production. Illustrative examples using the average and the range, the average and the standard deviation, the average only, or the fraction defective for various conditions are worked out step by step. The appendix includes factors for computing 3-sigma control limits and factors for computing probability control limits.

*Values in parentheses are intended to be indicative of order of magnitude only; they are present in significant amounts in very few of the glasses treated.

CURRENT STATISTICAL POSITION OF GLASS

THE GLASS INDUSTRY'S INDEX

Production Seven Months, January Through July



July activity in the glass industry showed a decrease from the June figures. As reported by the Production Index, production for July was $46,000,000 as compared with $49,000,000 for June and $44,000,000 for July of 1943. Output for the January-July period of 1944 was $333,000,000, comparing with $301,000,000 for the same months of 1943—an increase of 10 per cent.

Plate glass production for August was reported at 9,745,751 sq. ft. by the Hughes Statistical Bureau. This is an increase of about 18 per cent over the figure reported for July and an increase of slightly more than 38 per cent over August, 1943. A total of 69,155,395 sq. ft. has been produced during the first eight months of 1944, compared to 45,572,342 sq. ft. produced during the same months of 1943—an increase of around 34 per cent.

Glass container production for August was reported at 8,692,249 gross, by the Glass Container Association of America. This figure is 7 per cent higher than that reported for July and 5 per cent higher than the figure shown for August, 1943. During the first eight months of 1944 glass container production rose to 68,041,863 gross, as compared to 61,049,396 gross for the same period of 1943—an increase of about 11 per cent.

Shipments of glass containers during August totalled 8,514,089 gross, an increase of 9 per cent over July, and of about 6 per cent over August of last year. Total shipments reported for the period of January through August were 65,781,944 gross—an increase of 4 per cent over the same months of 1943.

Inventories on glass containers for August were 5,097,037 gross, slightly more than that reported for July, and a little more than 1 per cent above the August, 1943, figure.

Automatic tumbler production for August totalled 7,026,561 dozens, an increase of 35 per cent above the preceding month, and of 37 per cent over August of last year. Shipments of automatic tumblers for this month totalled 6,590,682 dozens, an increase of over 20 per cent above July and of 38 per cent over August, 1943. Finished stocks on hand at the end of August were reported at 7,076,976 dozens.

Table, kitchen and household glassware: Manufacturer's sales of machine-made table, kitchen and household glassware for August were reported at 3,201,730 dozens, an increase of 39 per cent over July, and of 35 per cent over August a year ago.

GLASS CONTAINER PRODUCTION AND INVENTORY

(All Figures Are in Gross)

		Production August 1944	*Stocks August* 1944
Foods; Medical & Health Supplies; Chemical, Household, Industrials; Toiletries & Cosmetics	Narrow Neck	2,858,725	1,945,965
	Wide Mouth	2,731,779	1,597,563
Dairy Products		255,370	362,058
Home Canning		247,622	375,447
Beverages		640,552	255,068
Beers		930,600	212,657
Liquors		712,652	260,381
Wines		253,359	76,405
Packers Tumblers		61,590	11,493
Total		8,692,249	5,097,037

GLASS CONTAINER SHIPMENTS

(All Figures Are in Gross)

Narrow Neck Containers	*August* 1944
Foods	809,038
Medicinal & Health Supplies	980,609
Chemical, Household, Industrials	553,683
Beverages	610,514
Beers	811,380
Liquors	626,907
Wines	264,589
Toiletries & Cosmetics	494,704
Sub-Total (Narrow Neck)	5,151,424
Wide Mouth Containers	
Foods	2,097,034
Dairy Products	271,154
Home Canning	278,214
Medicinal & Health Supplies	274,028
Chemical, Household, Industrials	145,985
Toiletries & Cosmetics	214,045
Packers Tumblers	82,205
Sub-Total (Wide Neck)	3,362,665
Total shipments	8,514,089

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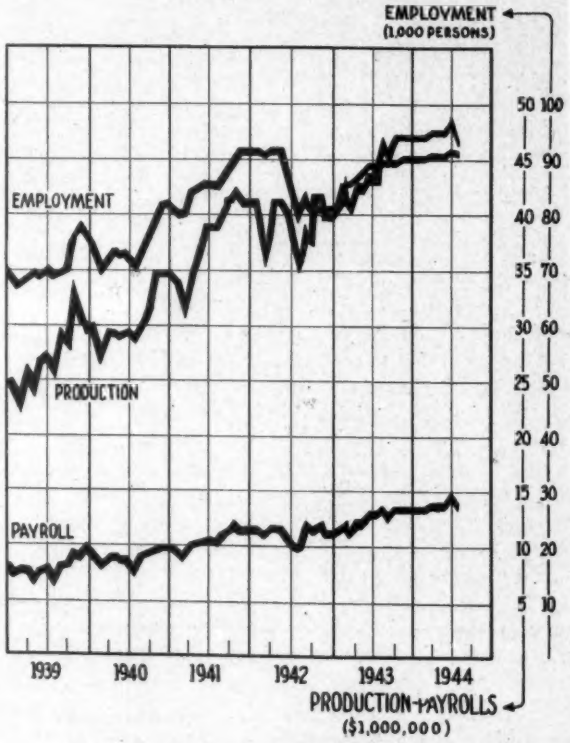
Miscellaneous glass products manufactured in July were estimated at $17,000,000—an increase of 6 per cent over June. The report also shows a 6 per cent increase over the July, 1943 figure.

Employment and payrolls: The total number of persons employed in the glass industry during July was 91,300. This compares with 92,700 employed in June, and 88,500 in July of last year.

Payrolls for July were estimated at $14,000,000—6 per cent less than the June figure. During the first seven months of 1944, glass manufacturers have paid approximately $98,000,000 in salaries.

GJI THE GLASS INDUSTRY'S INDEX

Monthly Trends Through July, 1944



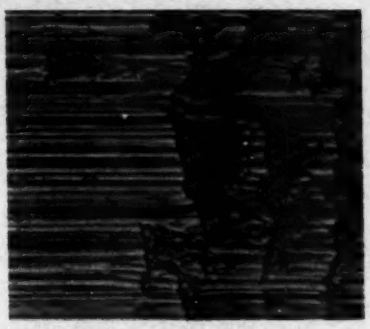
DIAMOND ALKALI HONORS FORMER EMPLOYEE

Colonel Donald M. Blakeslee, 27, a former operator in Diamond Alkali Company's Chlorine Department at its Painesville, Ohio, plant, was recently honored at a community testimonial dinner while home on leave at Painesville. He was presented with a watch by Raymond F. Evans, Diamond's Vice President and General Manager on behalf of the company.

Colonel Blakeslee is commander of the famed Mustang fighter group attached to the Eighth U. S. Air Force in England. His flying career has been spectacular and he undoubtedly is and will be one of the most decorated U. S. airmen. He has between 400 and 500 combat missions to his credit in the European theater. His group owns more "firsts" than any other U. S. air group.

NEW EQUIPMENT AND SUPPLIES

NEW METHOD OF SURFACE INSPECTION



Rex D. McDill, engineer and physicist of Cleveland, Ohio, has developed a method of surface inspection and comparison called Faxfilm. By the use of a solvent, one surface of a plastic film is softened enough to permit the making of a contact replica of any surface. This small piece of film is mounted in a cardboard frame which fits any standard projector where it can be enlarged 100 diameters or more and shows all contours in three dimensions. The film can then be filed for future record.

Faxfilm is speedy — requiring less than a minute to make. There are no complicated instruments required and it is inexpensive—6 cents each in small quantities and much less in large quantities. It is very accurate for it is an exact replica. The illustration shows a machine finished steel bar, finished to 250 RMS. The enlargement is to 100 diameters.

NEW AIR UNIT CONVERTS BENCH VISE TO AUTOMATIC MACHINE

Vispeed, a new powerful air or hand-operated bench vise has been developed by The Bellows Company, Akron, Ohio. This newest addition to the Bellows line of controlled air power devices consists of a standard 4" Reed bench vise operated by a powerful 8", foot-controlled, air cylinder. Clamping pressures are adjustable from zero up to 2½ tons, the practical safety limit of the vise itself.

Vispeed operates through the full range of the 6" jaw opening of the vise, positive safety control limits the air-powered movement of the movable jaws adjustable from zero to a maximum of 1".

The vise is foot controlled, leaving both hands free to handle work. Slight toe pressure closes the jaws, heel pressure opens them. Jaws lock in either position. Normal hand operation of the vise is possible at all times.

Vispeed is available as a complete packaged unit, consisting of a 4" standard Reed bench vise, an 8" air cylinder, pressure regulator, gauge, quick exhaust valve, air-hose and foot pedal assembly, or the air unit may be purchased separately for easy attachment to any standard 4" or 4½" vise.

ROLAMARKERS

Adolph Gottscho, Inc., New York City, has introduced a new product called "Rolamarkers." These are for imprinting trade marks, return addresses, contents, and other information on composition board, plastic, cloth, asbestos, etc. The Rolamarker illustrated is a Self Return for single imprints for marking cases and cartons.

The drum is made to hold fixed dies, interchangeable type, or a combination of both. It is equipped with as many channels as are needed for the interchangeable type. All Rolamarkers are automatically inked by one or two self-inking rollers. Assemblies have been manufactured for imprinting in two or three colors side by side.

The units are heavily constructed. Frames are of durable metal; drums are constructed accurately; ink rollers are of solid felt, precision ground when required. All Rolamarkers are made to specifications to suit the particular needs of the work to be done.

CATALOGUES RECEIVED

The Farval Corp., Cleveland, Ohio, has for distribution a new 16-page booklet, printed in three colors, whose theme is how centralized lubrication systems increase the production output of machinery and at the same time make savings in time, power and lubricating materials.

The information is very attractively presented and the booklet is a graphic portrayal of the theory and practice of mechanical lubrication.

Eisler Engineering Co., Newark, N. J., has just published a new 58-page catalogue (#CE-44W) entitled "Spot Welders" showing all types of standard and many special resistance welding

machines, manufactured by the Eisler Engineering Co., in the capacity-range from 3-KVA to heavy duty models up to 500-KVA.

The catalogue has over 300 illustrations displaying pictures of individual foot, air and motor operated welders of their line, shows application and installational views and gives specifications, operating and technical data on the various models generally employed in the diversified industries with heavy duty work.

Minnesota Mining & Manufacturing Co., St. Paul, Minn., has for distribution a new booklet that will prove helpful to anyone using adhesives or coating materials, impregnators, spray-on insulators and sound-deadening compounds. It is entitled "3-M Adhesive Data."

The booklet lists the various formulae as made by this company's Adhesive Division, Detroit, and shows the viscosity, bonding range, method of application, etc.

The Yale & Towne Mfg. Co., Philadelphia, Pa., has a new factual catalogue of KRON Scales made by them, for the use of buyers of precision industrial equipment. The catalogue presents the full story of the entire KRON Scale line from dormant and portable platform types of special counting, batching, tensile strength and dynamometer models.

CATALOGUE & BULLETIN SERVICE

Current catalogues and manufacturers' service bulletins received in this department may be obtained by writing to THE GLASS INDUSTRY.

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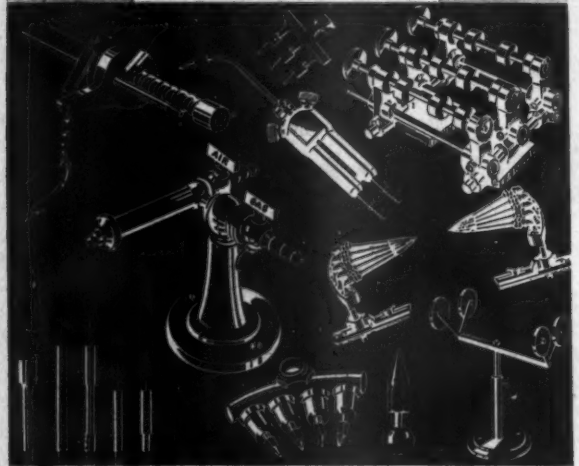

Glass working equipment manufacturers: glass ampules, vials, etc. Glass working lathes, bench fires and laboratory equipment of all types. Write for catalog

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NWLB DECISION WILL INCREASE PRODUCTION COSTS IN 47 GLASS COMPANIES

Because of the recent decision of the National War Labor Board requiring 47 member companies of the National Association of Manufacturers of Pressed and Blown Glassware to raise wages of miscellaneous workers, production costs in those companies will increase in varying degrees. There are also about 50 other glass manufacturers in the country which are not members of the National Association that may find it necessary to adjust their wage scales to conform to the NWLB decision for the purpose of stabilizing their labor situation.

It was originally presumed that a reasonable number of companies would petition the OPA to increase their ceiling prices. However, September 10 was the deadline for industry filing and, on that date, only six companies had so petitioned.

Although the OPA decision has not yet been rendered it is reasonable to forecast that since so few companies have sought relief there will be no basis for the OPA to recommend an increase in industry ceiling glassware prices. Those companies petitioning for relief may get individual ceiling prices raised if they can qualify under the requirements of existing OPA order MPR-188 and its amendment A-3.

DR. INSLEY APPOINTED TO POST AT PENN STATE COLLEGE

Dr. Herbert Insley, senior petrographer of the United States Bureau of Standards since 1922, has been appointed professor of petrography and head of the department of earth sciences at the Pennsylvania State College. He began his new duties on September 1.

Dr. Insley has an extensive experience in petrography, including research on glass, refractories and microscopic, x-ray, and electron microscopy work on the study of high temperature reactions of ceramic materials and other artificial silicates.

He is a graduate of Hamilton and earned his doctorate at Johns Hopkins. He has been associated with the Bureau of Standards as an assistant physicist (1917-18); with the United States Geological Survey, as an associate geologist (1919-21); and did petrography work for the Bureau of Mines (1921-22).

• In Order M-11-b, zinc is allowed for the manufacture of closures for glass containers—Item 21, List B. However, zinc is prohibited in the manufacture or as a protective coating for articles given in List A, which includes, among other things, ash trays, bookends, candlesticks, cosmetic containers, all ornamental and decorative glass, paper weights, smoking accessories, picture frames, etc.

VICE PRESIDENT OF ARMSTRONG CORK DIES

Dwight L. Armstrong, Vice President of the Armstrong Cork Company, died in Lancaster, Pa., on September 10 after an illness of four weeks. Mr. Armstrong was born in 1894 in Pittsburgh, the son of Charles D. Armstrong, former President of the Armstrong Cork Company, and grandson of Thomas M. Armstrong, founder of the Company.

Mr. Armstrong graduated from Yale University with the degree of A.B. in 1917. He enlisted in the Navy during the first World War and was commissioned as an Ensign. He entered the employ of the Armstrong Cork Company in 1919 in its Pittsburgh factory and served in various positions throughout the country until in 1933 he was made Vice President and General Manager of the Closure Division. In 1939 his responsibilities were broadened and he was attached to the President's Office as a general executive vice president. He was a member of the Company's Board of Directors since 1931.

Mr. Armstrong was prominently identified with the social and philanthropic activities of Lancaster City and County. He was also particularly well known as a golfer, having been a member of the Walker Cup Team and Central Pennsylvania Champion.

BATTELLE INSTITUTE NAMES MOCKRIN TO RESEARCH STAFF

Isadore Mockrin, formerly with the National Bureau of Standards, Washington, D. C., has become associated with the research staff of Battelle Institute in Columbus, Ohio, and assigned to its division of ceramic research.

Mr. Mockrin holds a Bachelor of Science degree in chemical engineering from the University of Pennsylvania and has attended George Washington University. He is a member of the American Chemical Society and the American Ceramic Society.

TEXAS GAS PIPELINE TO BE READY FOR USE IN JANUARY 1945

War Production Board officials have announced that the construction of the Texas gas pipeline is progressing satisfactorily and will probably be completed and in use around January 1, 1945. When finished, it will carry about 200,000,000 cubic feet of gas a day into the Appalachian area.

WPB representatives also report that the gas storage program is being carried out successfully.

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(*Continued from page* 454)

is important that he inspect parts made while he is at the machine and not those which have been produced fifteen minutes or one-half hour previously, because conditions might have changed and he is interested in conditions as they are now.

Whether he looks at one part or a dozen depends on how much information he requires to satisfy himself that the general process is satisfactory. He might also wish to inspect a few parts made some time previous to his arrival at the work area, to note whether or not there is some gradual change taking place in the tools.

If he finds conditions satisfactory and parts are being produced within the required specification, he notes on the Operation Inspection Tag the time of his inspection and the approximate number of pieces which have been produced since the beginning of the operation. This count may be conveniently taken from a veeder counter attached to the machine when possible.

Reference to Figure No. 12 will show that the inspector performed six such patrol inspections, averaging two inspections a day—one in the morning and one in the afternoon. The tag shows that up to 9:30 A.M., February 18, 1940, the process had produced 7,690 parts. It shows that the last part produced was approved on February 18, 1940. It also shows that the tool—in this case a die—requires regrinding before another run is started.

The tag is simple in form, easily understood by the foremen and operators, and gives a complete history of the running of the job.

If at any time during one of his patrol inspections, the inspector finds the process producing defective parts, he merely lifts the Operation Inspection Tag, which automatically informs the operator that he must make adjustments to the process or machine. This literally stops the operation, and it is then the foreman's responsibility to get conditions corrected before the inspector will approve the operation for further production.

Fig. 15.

Fig. 16.

It has been found that by the application of the principles of first piece and patrol inspection the control of quality of parts can be so effective that parts can be put into assembly lines without any further inspection.

Figure No. 15 shows an assembly line to which parts are fed which have been produced under conditions of first piece and patrol inspection. Although the equipment assembled on this line has the precision and accuracy of operation approaching that of a good watch, the parts are literally "thrown together" because they are so completely interchangeable.

On the assembly line, and similar assembly lines, quality is controlled by the inspector "patrolling the line," although he does not go through the formality of using an Operation Inspection Tag, such as shown in Figure No. 12. By patrolling the line, he observes which operators perform operations satisfactorily, and which operators need instruction or are careless. All assembled equipment receives a thorough electrical test, to determine the proper operating characteristics. However, a thorough patrolling of the assembly lines assures a minimum of rejects at this electrical test station.

One important feature which is ordinarily lost sight of is the checking on the inspector. It is generally assumed that the inspector makes no mistakes. However, in a thorough quality control program, provision must be made for "inspecting the inspector's work."

Figure No. 16 shows an inspection supervisor (with his back to the reader) checking on the inspector. This supervisor inspects equipments which have been packed and are ready for shipment. First, he inspects the carton and method of packing. He then opens the carton and reinspects the equipment, to assure himself that the customer is actually getting what he is paying for. He then takes the equipment back to the test station and subjects it to a thorough electrical test, as a check on the test operation.

(*Continued on page* 468)

DEDICATED TO RESEARCH

DURING the first week of October, this doorway to the Whitemarsh Research Laboratories officially opened, and the new home of Penn Salt's Research and Development Department was formally dedicated.

Here will be continued the important work of Penn Salt's rapidly growing staff of chemists, engineers and other technologists. With greatly enlarged facilities, they will be well-equipped to bear a substantial share of the increased responsibility imposed on industry by wartime's fast changing economy. Materials, not even dreamed of yesterday, already have become commonplace. And still more remarkable things are in store for the world of tomorrow.

This great building symbolizes the transformation that is taking place in the field of practical research.

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CONTROLLING QUALITY . . .

(*Continued from page* 466)

These checks, or reinspections, sometimes are rather elaborate. In the case of equipments like refrigerators, electric ranges, and water heaters, complete and thoroughly equipped electrical laboratories, staffed by graduate engineers, are used. Merchandise is brought back from the warehouse, having been picked at random, and put through its paces in the Quality Control Laboratory, to discover any weaknesses that might have been overlooked by the regular quality control organization during production, and also to discover inherent design weaknesses.

The program for controlling quality described here might appear rather elaborate. However, there is no substitute for quality, and the responsibility for building a quality product must be at all times placed at the door of the manufacturing people. Truly, quality must be built into a product, it cannot be inspected into it.

INVENTIONS AND INVENTORS . . .

(*Continued from page* 459)

Edwin H. Land of the Polaroid Corp. received three patents for light polarizing systems. These are 2,356,250 to 2,356,252. The first of these concerns laminated glass with a center layer of cellulose acetate containing polarizing particles, with special emphasis on the cementing material which is a mixture of a polymerized incomplete polyvinyl acetal resin and glycerol triricinoleate. For the alignment of the crystals which is necessary in Polaroid, patent 2,356,251 teaches a process in which the crystals are of such a nature that they may be aligned when subjected to an exterior force to which they are responsive. The third patent details methods of making laminated glass for headlight lenses, viewing visors etc.

Glass Wool and Fiber

Harold T. Coss and associates in Johns-Manville Corp. received three patents for mineral wool treatment and use. Patent 2,356,827 describes a method for insulating the inside surfaces of a box-like container. Patent 2,356,826 in the conception of which Coss was joined by Wm. M. MacAlpine and Louis A. Hawthorne, describes a process of using glass wool or mineral wool for making a rigid felted product. The fibers are collected on a conveyor at the floor level of the blowing room at which point they already have received the bituminous binder, and then pass between forming rolls and belting into a heating chamber which gives the binder a satisfactory distribution. Thereafter the continous felted mass is cooled to harden it and then is heated again at the surface and slightly compressed. The third patent, 2,357,042, (Coss joined by L. A. Hawthorne and J. H. Zettel), also concerns a felted product which is given a surface compression, but in this case one of the last steps is the application of a coating material to the surface of the felt to strengthen it.

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2. **INCREASED PRODUCTION** through utilization of a greater portion of the melting area and the delivery of a higher percentage of acceptable ware.

3. **SLOWER DETERIORATION** with lower maintenance costs because of flame control and uniform heating of the glass.

4. **COOLER CROWN TEMPERATURE** upward to 300 degrees lower than usual, due to an overlying blanket of air that directs the heat down to the surface of the glass.

5. **EFFICIENT COLOR CONTROL.** Lower maximum temperatures through uniform control which prevents flashing of decolorizers while segregation of decolorizer near the bottom is restrained by higher bottom temperatures.

Write for Bulletin No. 539 giving the complete story.

TOLEDO ENGINEERING Company

GLASS MELTING and MANUFACTURING EQUIPMENT

EASTERN OFFICE 220 E. LEXINGTON ST. BALTIMORE MD. • • • 958 Wall St. TOLEDO, O.

GCA FALL MEETING . . .

(*Continued from page* 456)

(1) Confidential Reports on breakage and design of various types of bottles; e.g., confidential reports on beverage, fruit jars, milk bottles, single trip beers and others.
(2) Diagnosis of cause of customer's breakage.
(3) Reports to New York Fire Department.
(4) Testimony before California Legislature.
(5) Plant visits on various problems.

These special service assignments are done only at the request of you people and are always done on projects that are within the scope of testing, breakage, and quality.

Probably the most important discovery in the research on testing and mechanical strength is the fact that the strength of glass ware depends primarily on the condition of its surface. Minor bruises, scratches, abrasions, and cracks ruin the strength of the ware, the most sensational example being internal abrasions or scratches on re-used bottles. Re-used beer bottles become more and more damaged and finally break. That is one reason why the re-used bottle should have a thick wall.

In the Cord Research by Dr. Knight the main result, although there have been a few sidelights, has been the Centrifuge Technique which measures density differences of the glass within a particular bottle. A density distribution curve gives the spread of the density and the relative amounts of glass of various densities. This is a technique for studying the extent and the cause of cordiness and supplements the polariscope test and other tests for cord. It is a method for diagnosing the cause of cord. Density distribution curves have been classified according to types and the probable cause of cord for a particular type. Also a point rating system has been developed which gives a cord grading on a furnace independently from that given by the polariscope. Perhaps its greatest use is as a trouble-shooting tool where the cord is separated, making it possible to run a chemical analysis on the cord itself and thus find the composition—an important step in finding the cause.

At the present time the cord research is also about half trouble-shooting service. The equipment is fairly intricate and requires care and experience in operation. We have not recommended that every plant install a centrifuge; it is a highly specialized tool to be used most efficiently in a central laboratory and it will probably work out best, for every one concerned, to send their cord problems to us when a centrifuge test is wanted. However, four laboratories, to my knowledge, have installed or are building centrifuges for a study of density differences within the glass in a particular bottle.

This work on density differences within the glass in a particular bottle has recently renewed our interest in day to day differences of the density of lumps of glass representative of the day to day furnace glass. This representative density of the furnace glass varies from day to day. Many plants plot these daily densities in the same way that they plot chemical analyses. Cord usually accompanies sharp day to day fluctuations of density. If one were to prevent cord in the first place, as distinguished from diagnosing its cause after it occurred, it is important to avoid these daily fluctuations in density.

For the past six months we have been investigating the causes of day to day variations of density and find that a predominant cause is scale errors in the batch house. The new Control Chart Method has been applied to assist in studying and eliminating the variation. My technical paper will be published shortly. This paper includes some statistics and is full of terms such as spread, range, standard deviation, 3-sigma limit, measure of variability, but on the whole the method is simple and can be followed and applied by any laboratory man. You will be interested in this if you are interested in preventing cord, and, of course, you are interested in that.

This points the way to a method of control of cord that is better than chemical analysis and renews interest in good, fast, precise, methods of measuring density. Based on our experience with sink-float density measurements in the centrifuge we are now working on a sink-float density measurement method for plants. We propose to write a report, giving the method in detail, and just how it can be operated by any high school girl to give, quickly, dependable data. We hope this will be a result of our cord research that will be of immediate application and help to all plants.

In the beginning, our work was defensive—defense of lawsuit. Our attitude is now changed, and I needn't urge you in changing yours to look to the post-war period where we must be aggressive. Quality and service, particularly the elimination of breakage in your customer's plants is going to be very important in meeting competition from other materials. We shall work harder than ever on practical ways to upgrade quality because I'm certain that that is going to be important to you.

ADVERTISING MANAGERS NAMED FOR DIVISIONS OF OWENS-ILLINOIS

As part of the postwar plans for Owens-Illinois Glass Co., principal operating divisions have been set up to direct their own advertising, merchandising and product publicity.

Howard A. Trumbull, associated with the company for eleven years, and former merchandising manager of the Glass Container division, has been appointed to the newly-created post of manager of sales promotion of that division. He has established a complete, co-ordinated unit and will direct and be responsible for all glass container advertising, merchandising and product publicity.

Thirteen men have been selected to head up the different phases of advertising coming under the jurisdiction of the Glass Container division.

Carl Fauster, merchandising manager of Libbey Glass division, has been named manager of advertising and merchandising for that division. George Baldwin has been transferred from the General Advertising department, which ceases to exist under the new setup, to the Insulux Products division as advertising manager.

• Walter G. Reethof, of Reethof-Fischmann Corporation, New York City, has recently been appointed manager of the Thatcher Manufacturing Co. Export Department.

CORHART* ELECTROCAST DOES A GOOD JOB— PLUS!

ON July 3, 1941, one of our customers started operation of a new Corhart balanced tank, melting flint bottle glass. After 860 days and 62,559.19 tons, the tank was shut down (on Nov. 11, 1943) for a 13-day partial repair.

At the time of this shutdown, the tank had produced 142.18 tons of glass per square foot, which in itself is a good record.

After the tank had cooled, however, careful inspection showed that the Corhart sidewalls and throat could be left intact for another campaign by overcoating at the metal line and making repairs to the superstructure. These repairs were made and the tank was started up again Nov. 25, 1943.

The operating data for the whole of the first period and for the second period up through May 31, 1944, is as follows:

Melting Area 440 Sq. Ft.	Total Days Life	Total Operating Days	Idle Days	Total Tons Flint Glass	Tons of Glass Per Sq. Ft. Per Life
7/3/41 to 11/11/43	860	844	16	62559.19	142.18
Down Period			13		
11/24/43 to 5/31/44 (Still Operating)	189	186	3	15613.58	35.48
TOTAL	1049	1030	32	78172.77	177.66

We will report to you, later, as to the outcome of this complete two-run campaign. As things appear now, we will be unable to give complete details until sometime in the first half of 1945.

Corhart Refractories Company, *Incorporated,* Sixteenth and Lee Streets, Louisville 10, Kentucky.

*Not a product, but a registered trade-mark.

QUALITY ECONOMY ENDURANCE

CORHART ELECTROCAST REFRACTORIES

POLAROID

Glass Inspection polariscope

Large Field—Brilliant Strain Patterns
Adjustable—Binocular Viewing—Precise

If your problem is strain detection we can help you through Standard Equipment or Special adaptations.

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SPECIAL SIZES AND SHAPES

. . . of firebrick made accurately and quickly right on the job, assuring tighter joints and longer lasting walls and arches in furnaces and kilns.

Low Cost cutting of all Refractories and Masonry Materials, regardless of hardness.

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FREE TRIAL
INFORMATION ON REQUEST

GLASS DIVISION MEETING . . .

(*Continued from page 449*)

influence of ions of non-noble gas character on the constitution and the optical properties of glass, and surface chemical reactions. In respect to the last group of problems he pointed out how advantage was taken of a borderline field which most glass technologists would think rather remote; froth flotation. H. H. Kellogg, in charge of mineral beneficiation at the School of Mineral Industries, who is one of the part-time collaborators of Glass Science, is studying surface changes of glass, by determining the contact angle of an air bubble pressed against a glass plate immersed in water. One can determine the adsorption of certain ions at the glass surface by means of indicators. This method, borrowed from the field of froth flotation, has already given interesting results which help to explain the protective acion of aluminum and beryllium ions on the surface attack of glass by alkali.

The speaker used the opportunity to answer several questions and inquiries which he had received since the foundation of Glass Science early this year. The limitations in space and personnel will limit the growth of this organization and consequently no efforts have been made to invite new members. Expansion would be desirable and has been planned, but it is uncertain whether the expansion will lead to a centralized or a decentralized institution. Also the question of the final location of the organization can not be answered in the immediate future.

JOHN R. HOSTETTER RESIGNS POST WITH WPB

Announcement has been received that John R. Hostetter, Chief of the Glass Unit, Chemicals Bureau, War Production Board, has resigned to accept a position as executive of the Glass Division of the Zenith Optical Company, Huntington, W. Va. His resignation was effective as of September 25th.

Mr. Hostetter will be in charge of glass manufacture at Zenith Optical, which company specializes in the production of radar, radio and other scientific glassware.

Mr. Thomas H. Tremearne will succeed Mr. Hostetter, becoming Acting Chief of the Glass Unit, Chemicals Bureau. He was transferred from the Agriculture Chemical Section of the Chemicals Bureau, WPB, and in that capacity has had some connection with the glass industry.

THATCHER INTRODUCES NEW SQUARE MILK BOTTLE

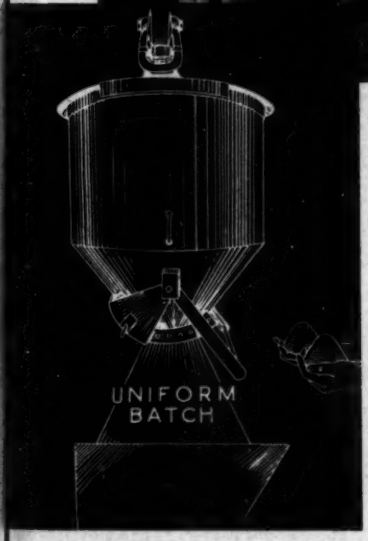
The new Thatcher Manufacturing Company's T-Square milk bottle has met with approval by the consumers on "test" routes throughout the country. The new bottle is only $8\frac{5}{8}$th inches in height, as compared to $9\frac{1}{2}$ inches for the old style bottle and it is only $3\frac{5}{16}$th inches in diameter.

Although the big advantage of the Thatcher T-Square milk bottle is its space saving facility both to storekeeper and consumer, one of its most important features is that it handles easier, and pours easier and faster than the round bottle commonly in use.

• Darrell E. Briner, after many years as chief designer with the Overmyer Mould Company, has opened his own industrial designing service in Springfield, Ohio. He will offer engineered designs for all types of glassware.

,000 TONS BATCH MATERIALS . . .

Glass batch is conveyed in buckets from the mixer to the furnace doghouse. The buckets are provided with individual carriers and are usually pushed in trains of three or more by hand or by motor-driven tractors.



Every handful of mix delivered to glass furnaces by a Cleveland Tramrail System is exactly like every other handful.

are being handled daily with CLEVELAND TRAMRAIL EQUIPMENT

This figure represents all glass plants served by Cleveland Tramrail small and large, requiring from 60 tons to 1200 tons every 24 hours. Automatic, semi-automatic and simple hand-propelled systems are in use.

The Cleveland Tramrail method of batch handling makes possible consistently high quality uniform glass because hour after hour, it delivers to the doghouse, batch that is properly mixed and in exactly the proportions desired.

Because of the great reduction in losses and improvement in quality, a Cleveland Tramrail batch-handling system not only quickly pays for itself, but is an important factor to better profits.

Regardless of what priority you can furnish, get information on this equipment now and prepare the groundwork for improving your manufacturing methods.

GET THIS BOOK!

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
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MANUFACTURERS OF • CLEVELAND CRANES • CLEVELAND TRAMRAIL • STEELWELD BENDING PRESSES

LET No. 2009 . . . Describes glass plants
Cleveland Tramrail. Contains engineering

CLEVELAND TRAMRAIL

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• The first printing of the Handbook of the Glass Industry has become exhausted and the continued demand for copies has resulted in a second binding.

Through printing economies obtained by a lowered unit cost in the second printing of the Handbook we are able to offer this useful, ready reference glassman's handbook at the *reduced price of $3.50 per copy.*

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CORNING BUYS SUBSTANTIAL INTEREST IN BRAZILIAN COMPANY

Corning Glass Works recently announced that it had acquired a large interest in Brazil's leading glass company, Vidaria Santa Marina of Sao Paulo. The majority control will be retained by the original owners in South America, but Corning will be represented on the board of directors.

The Brazilian investment was made through a holding company, Corning Glass Works of South America, organized to handle all of the company's interests in the Southern Hemisphere. William H. Curtiss, vice president and secretary of Corning Glass Works, has been elected president of the South American subsidiary, and Lawrence King managing director of operations.

NATIONAL POWER SHOW TO BE HELD IN NEW YORK CITY

The sixteenth National Exposition of Power and Mechanical Engineering will be held in Madison Square Garden, New York City, November 27 to December 2.

A review of products to be on display indicates that the following classifications will be well represented: heat and power production, distribution of energy, control appliances, auxiliary apparatus, instruments for indicating and recording measurements of quantities and pressures, power transmissions, material handling equipment, engineering materials, engineering specialties, machines and tools.

WICKWIRE SPENCER'S MECHANICAL SPECIALTIES DIVISION MOVES FROM NEW YORK CITY

The Wickwire Spencer Steel Company has moved the General Sales Office of the Mechanical Specialties Division from New York City to Clinton, Massachusetts, where the products of this division are manufactured. However, a District Sales Office of this division will continue to be maintained in New York.

Since the products of this Wickwire Spencer unit are highly specialized it is felt that the relocation of the General Sales Office will enable this division to better serve customers through closer coordination of sales and manufacturing, including operating, engineering and scheduling. These products include, Industrial Wire Cloth, Metal Conveyor Belts, Card and Napper Clothing, Perforated Metals and Grilles.

PITTSBURGH PLATE APPOINTS NEW ASSISTANT COMPTROLLERS

Pittsburgh Plate Glass Company has announced the appointment of R. W. Mothershed, chief warehouse auditor, and A. W. Smiley, general auditor, as assistant comptrollers of the company.

Mr. Mothershed became associated with Pittsburgh Plate in 1918 and since 1937 has acted as general supervisor of all travelling auditors throughout the company's branch warehouse system.

Mr. Smiley has been with the company for 15 years and since 1942 has been general auditor of all company operations except those of the commercial department.

NEW HEADQUARTERS FOR A.C.S. DISCUSSED AT UNIONTOWN MEETING

As a result of a letter directed to approximately sixty-five members of the American Ceramic Society last May, urging consideration of a new building or enlarged headquarters for the Society, considerable interest in the idea was developed and a committee was appointed by the Board of Trustees to study the matter and make its recommendations to the Board at its meeting in Uniontown on September 15th.

Replies to the original letter suggesting the idea indicated it was felt that a new building would be a considerable undertaking for the Society. However, C. Forrest Tefft, as chairman of the temporary committee appointed to consider the project, recommended that new or enlarged headquarters should definitely be considered. To properly pursue the idea it was recommended that a permanent Building Committee be appointed which recommendation the Board of Trustees accepted and President E. H. Fritz was authorized to appoint the committee.

The original committee of five were re-appointed to the permanent Building Committee with Mr. Tefft continuing as Chairman.

MATHIESON ALKALI OPERATING NEW AMMONIA PLANT

The Mathieson Alkali Works (Inc.) has announced the production of ammonia from a new plant at Lake Charles, La. This plant is one of the two largest in the country producing ammonia from natural gas.

This plant, built by the Defense Plant Corporation and operated under lease by Mathieson, is fully engaged in war production, the ammonia being used to produce high explosives. After the war, the plant is expected to manufacture chemical fertilizers for Southern farmers and anhydrous ammonia for refrigeration.

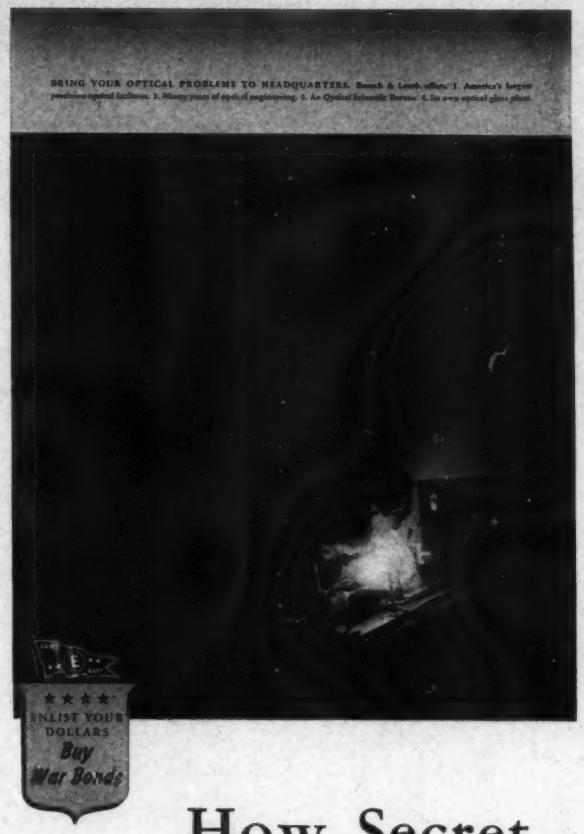
In addition to ammonia, Mathieson produces caustic soda, soda ash and synthetic salt cake at the Lake Charles plant.

T. K. ALMROTH OF OWENS-ILLINOIS TO RESIGN

Thomas K. Almroth, general advertising manager of Owens-Illinois Glass Company, will resign on October 15. He has been associated with the firm for almost 30 years. Mr. Almroth said his decision was based largely on the conviction that the wide experience he has gained can be put to broader use in the period following the war. His future plans will be announced at a later date.

Mr. Almroth is a charter member and past president of the Toledo Industrial Marketers, a chapter of the National Industrial Advertising Association. He has represented Owens-Illinois for ten years in the Association of National Advertisers.

• Item (8) in List A of Order M-39 continues to prohibit the use of lead or lead base alloys in the production of glass for ornamental purposes. The War Production Board leaves the manufacturer to determine which items of his production of glass are ornamental, as WPB has issued no definition regarding this matter.



How Secret Weapons Are Born

A brightly lighted laboratory window in a darkened building . . . a closely guarded door . . . by signs such as these you may recognize the hardworking scientists who are creating America's deadliest new fighting tools, through the O.S.R.D. (Office of Scientific Research and Development). Armed with the instruments which science knows best how to use, these selfless six thousand have already saved unnumbered lives, ships and planes.

They work in hundreds of laboratories throughout the country, laboratories which are equipped with the finest precision optical instruments. Their work is coordinated by a scientific high command, the O.S.R.D. They wear no uniforms nor medals, but work tirelessly for the triumph of Freedom.

We are proud to be able to cooperate with the scientists working under O.S.R.D.; proud, too, of the part that our instruments have played in the furtherance of their efforts. In the able hands of these men the microscopes, spectrographs, metallographs, refractometers, projection equipment, and other specialized Bausch & Lomb instruments have become weapons of war . . . as important to the winning of battles as the rangefinders, aerial camera lenses, binoculars, and other B&L military optical instruments.

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